NASA SP-12



# RESULTS OF THE THIRD UNITED STATES MANNED ORBITAL SPACE FLIGHT

## OCTOBER 3, 1962

128p.



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Manned Spacecraft Center

PROJECT MERCURY

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NATIONAL AERONAUTICS
AND SPACE ADMINISTRATION
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# FOREWORD

This document presents the results of the third United States manned orbital space flight conducted on October 3, 1962. The performance discussions of the spacecraft and launch-vehicle systems, the flight control personnel, and the astronaut, together with a detailed analysis of the medical aspects of the flight, form a continuation of the information previously published for the first two United States manned orbital flights, conducted on February 20 and May 24, 1962, and the two manned suborbital space flights.

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# 1. SPACECRAFT AND LAUNCH-VEHICLE PERFORMANCE

By JOHN H. BOYNTON, *Mercury Project Office;* and LEWIS R. FISHER, *Mercury Project Office*

## Summary

The Mercury spacecraft and the Atlas launch vehicle used in the orbital flight of Astronaut Walter M. Schirra, Jr., performed extremely well in every respect. All objectives of the eighth Mercury-Atlas mission (MA–8) were accomplished, and no malfunctions occurred which compromised the success of the mission. The third United States manned orbital flight marked another key milestone in the Mercury program, in that the period of observation in space for both the astronaut and the spacecraft systems was twice that of previous missions. The only anomaly which caused concern during the flight was an elevated suit temperature experienced in the first 2 hours after launch. This condition was later found to have resulted from a foreign substance in the control valve, but the flight control task was further aggravated by a difference between the suit-inlet temperature readings telemetered to the ground stations and those indicated to the astronaut by the instrument panel gages. However, the elevated temperature condition was adequately remedied through effective system monitoring and methodical control-valve manipulation by the astronaut. The scientific experiments included in the mission provided valuable information regarding physiographic features of the earth, the selection of filters for weather photography, nuclear radiation in terrestrial space, and the effectiveness of advanced ablation materials during an orbital reentry. The excellent performance of the man-spacecraft system during the MA–8 flight provided information and evidence which supports the immediate advancement of essentially this same system into missions of even greater duration with more ambitious objectives.

## Introduction

The eighth Mercury-Atlas mission (MA–8) was planned for up to six orbital passes and was a continuation of a program to acquire new knowledge while extending the operational experience in manned orbital space flight. The objectives of the flight were to evaluate the performance of the man-spacecraft system in a six-pass orbital mission, to evaluate the effects of an extended orbital space flight on the astronaut, to obtain additional evaluation by the astronaut of the operational suitability of the spacecraft systems, to evaluate the performance of spacecraft systems which had been modified, and to exercise and evaluate further the performance of the Mercury Worldwide Network and mission support forces in order to establish their suitability for extended manned orbital flight.

The Mercury spacecraft, *Sigma 7*, and the Atlas launch vehicle used by Astronaut Schirra in successfully performing the third United States manned orbital mission were nearly identical to those used for the MA–6 and MA–7 flights. The spacecraft provided a habitable environment for the astronaut in space and protected him during the elevated heating phases of powered flight and reentry. The spacecraft also served as a laboratory in space where valuable scientific experiments were conducted. The intent of this paper is to describe briefly the significant changes incorporated into the MA–8 spacecraft and launch vehicle since the previous flight and to discuss the performance of the spaceborne systems. References 1 and 2 should be consulted for complete descriptions of the systems discussed in this paper. The spacecraft systems include those of heat protection, mechanical and pyro-

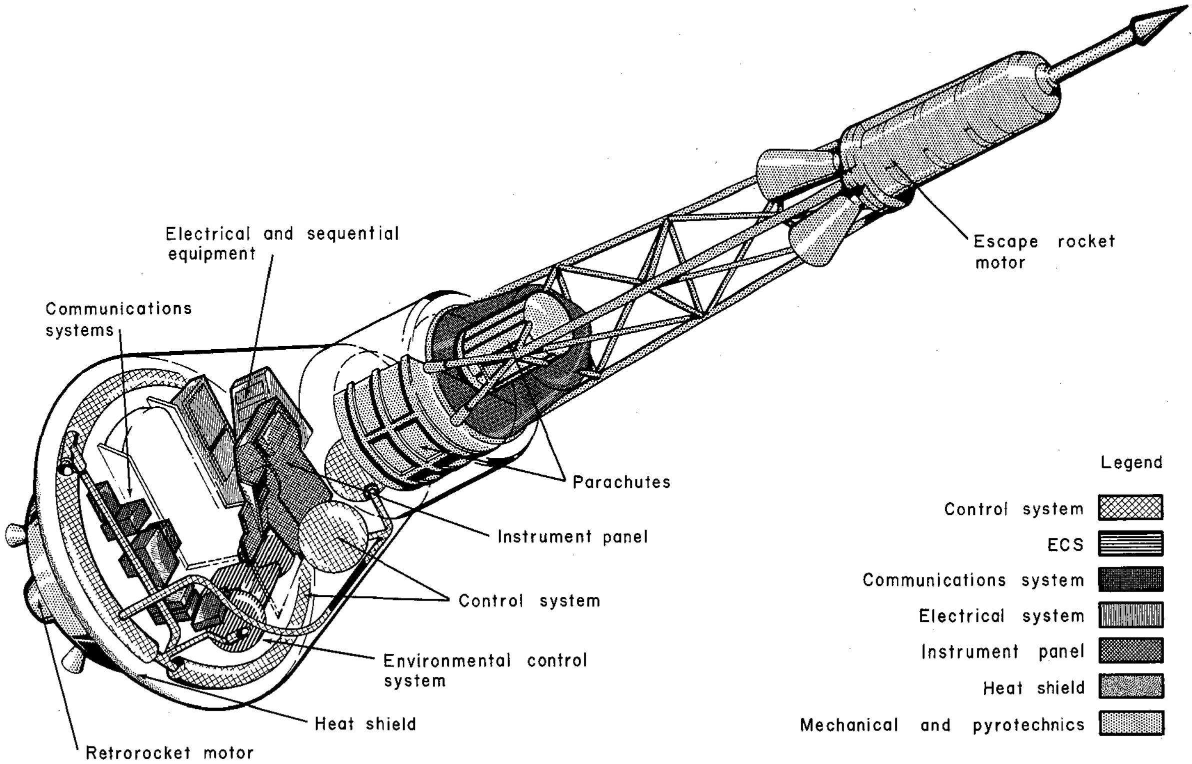


FIGURE 1-1.—Spacecraft interior arrangement.

technic, spacecraft control, communications, instrumentation, life support, and electrical and sequential. The arrangement of these systems within the spacecraft is illustrated by a simplified schematic diagram in figure 1-1.

### Heat Protection System

The performance of the heat protection system was satisfactory. Through the use of an ablative-type heat shield, insulation in a double-wall afterbody structure, and heat-sink beryllium shingles on the cylindrical section, the Mercury spacecraft is protected against excessive heating during exit and reentry flight through the atmosphere. An alteration to the heat protection system since the previous mission was the bonding of nine ablation material samples to the exterior surface of the cylindrical section shingles. The ablation samples were added only as an experimental study, which is discussed in the section entitled "Scientific Experiments," and were not installed with the intention of altering the effectiveness of the beryllium shingles for this mission.

All temperature data, as recorded from thermocouples located around the exterior of the spacecraft, were within expected ranges and were in excellent agreement with measurements taken during previous orbital missions (see refs. 1 and 2).

### Mechanical and Pyrotechnic Systems

The mechanical and pyrotechnic systems consist of the separation devices, the landing system, the rocket motors, and the internal spacecraft structure. These systems functioned normally throughout the mission. The configuration of these systems was nearly identical to that of the previous orbital missions. The notable changes from the MA-7 mission were the removal of the heater blankets from around the retrorocket motors in order to conserve weight and the addition of a SOFAR bomb to be ejected at main parachute deployment and detonated at 2,500 feet below the surface of the water to assist in the location of the spacecraft after landing.

The primary separation interfaces are those between the spacecraft and the escape tower, between the spacecraft and the launch vehicle, at the heat shield, and around the spacecraft hatch. All separation devices performed effectively during the mission, including the explosive-actuated side hatch which was deployed by the astronaut after the spacecraft had been placed on the deck of the recovery ship.

The landing system includes the landing-shock attentuation system (landing bag) and the drogue, main, and reserve parachutes. These systems were unchanged from MA–7 spacecraft configuration. The landing system performed satisfactorily; the drogue parachute was deployed manually, as planned, at a pressure altitude of 39,400 feet, and the main parachute sequence was initiated automatically at a pressure altitude of 10,600 feet, which was within specification limits. The only incident of an anomalous nature was the slight tearing of the main-parachute deployment bag. Both the drogue and main parachutes performed properly and were undamaged during descent.

The escape, posigrade, and retrograde rocket motors operated satisfactorily, and their thrust levels were within specification limits. The internal spacecraft structure was found to be entirely normal during the postflight inspection.

### Spacecraft Control System

In accomplishing the task of providing attitude and rate control of the spacecraft during the orbital and reentry phases, the spacecraft control system performed satisfactorily throughout the entire flight. The control system was essentially equivalent to that which was installed in the MA–7 spacecraft with but minor changes. These changes include widening the limit cycle or deadband of the automatic stabilization and control system (ASCS) in the orbit mode from $\pm 3°$ to $\pm 5.5°$ to conserve fuel, incorporating an "attitude select" switch for maintaining either retroattitude or reentry attitude in the orbit mode of ASCS, providing a switch to disable the high (24-pound) thrusters in the fly-by-wire mode during normal orbital operations (see fig. 1–2), and installing a modified cover for the pitch horizon scanner to alleviate possible thermal effects during ascent. An automatic feature existed which made the high thrusters operative at retrofire when using fly-by-wire to provide rapid spacecraft alinement and to control any angular rates which might occur.

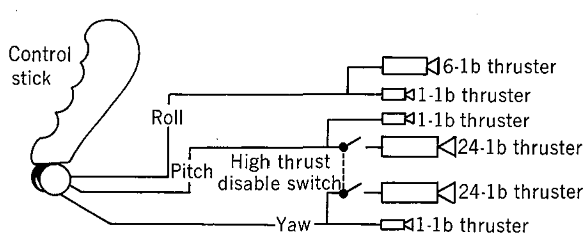


FIGURE 1–2.—Fly-by-wire thrust-select-switch modification.

#### Control System Electronics

One unexpected occurrence of minor significance during the flight was that the deadband obtained with the ASCS was greater than expected. For example, the deadband was approximately $\pm 8°$ for the initial thrust pulse instead of the planned $\pm 5.5°$ mentioned previously. The exact reason for this anomaly is unknown, but preliminary studies indicate that the duration of the thrust pulses at the given attitude limits was less than expected. This disparity did not adversely affect control system performance or control fuel usage.

Brief voltage transients were indicated across the solenoid valves for the 24-pound automatic-system thrusters when the astronaut switched from ASCS orbit mode to another method of control, but these transients were insufficient to operate the solenoid valves and are, therefore, not considered to have been of a serious nature.

#### Fuel Usage

The usage rate of hydrogen peroxide control fuel was less than had been predicted for the MA–8 mission. The mission had been planned for minimum fuel usage, a philosophy which was incorporated into the schedule of inflight activities, and the astronaut adhered strictly to this flight plan. This result is especially satisfying when the fuel usage of the two previous flights is compared with that of the MA–8 mission, which was of much longer duration. The time history of fuel remaining for the MA–8 flight is presented in figure 1–3. Although no additional fuel was included, a number of minor changes in equipment and flight procedures contributed to the increased fuel economy. The addition of a switch to disable the high thrusters when they were not needed permitted the pilot greater freedom in stick motion, since he then was not required to restrain his hand movement within a fixed range to activate only the economical low thrusters. This switch, therefore, eliminated the possibility of inadvertently using the fuel-

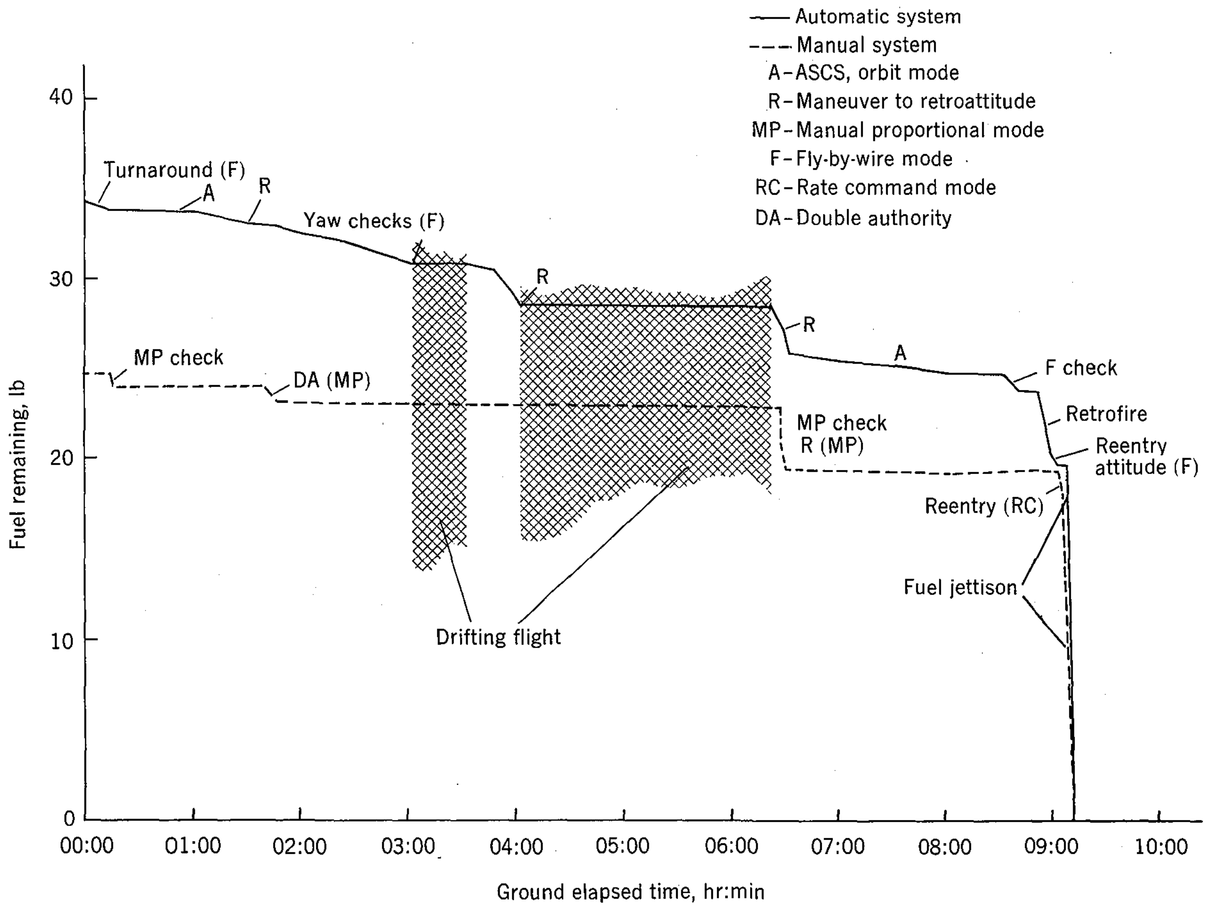


FIGURE 1-3.—Fuel usage rates.

costly high thrusters during situations in which the pilot's attention might be distracted. The widening of the ASCS deadband was done in an effort to reduce the number and duration of control pulses per unit time and, therefore, the amount of total fuel consumed. The primary technique to reduce fuel consumption, however, was the fact that the flight procedure included long periods of attitude-free drifting flight. During some of these periods, very small quantities of fuel were used at times to maintain spacecraft attitudes within the limits of the horizon scanners. When it was important to have the spacecraft at retroattitude for a possible mission abort, the ASCS orbit mode, which involves very small quantities of fuel, was utilized. Finally, the flight plan intentionally excluded control maneuvers which would have caused large quantities of fuel to be consumed. It must be emphasized, however, that the previously mentioned factors were complementary to the pilot's discreet management of control system operations, for which he alone was responsible. Astronaut Schirra's discipline in using control fuel was the primary reason for the favorably low rate of expenditure.

### Communication Systems

Performance of the spacecraft communication systems throughout the entire mission was satisfactory. The communication systems used in the spacecraft for the MA-8 flight were very similar to those employed for the two previous orbital missions. There were, however, some notable changes from MA-7. The voice system included a more sensitive and effective microphone in the astronaut's helmet (fig. 1-4), a dipole antenna (fig. 1-5) to be used for orbital high-frequency (HF) voice communications, a hardline link from the spacecraft to the liferaft for possible use after landing, and a miniature ultra-high-frequency (UHF) transceiver which was added to the survival kit in the liferaft. The HF recovery transceiver was removed for the MA–8 mission. In addition, one of the two previously used command receivers and de-

FIGURE 1–4.—Closeup photograph of microphone installed in the helmet.

coders was removed in an effort to save weight, since these units have exhibited a high reliability in previous missions. The astronaut had the capability to switch the HF transceiver to either the standard bicone antenna or the dipole antenna.

#### Voice Communications

During the launch phase, the background noise caused triggering of the voice-operated relay within the spacecraft transmitter which precluded reception in the spacecraft for brief

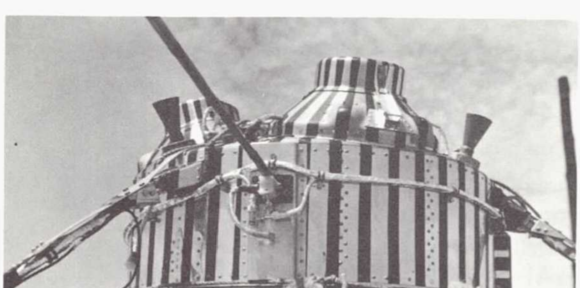

FIGURE 1–5.—High-frequency dipole orbital antenna.

periods of ground-to-air communications. This triggering or keying was apparently the result of the increased sensitivity of the new microphone installed in lieu of the two less efficient units previously flown. During the orbital phase, the range of HF reception and transmission was considerably improved over that of previous orbital missions, undoubtedly as a result of the new HF orbital antenna. Most of the ground stations around the Mercury Worldwide Network reported effective HF and UHF voice contact with the astronaut, who also reported that reception from all stations was exceptionally good.

#### Radar Beacons

The performance of the C- and S-band radar beacons was satisfactory for the MA–8 flight, but the C-band beacon experienced slight amplitude and frequency modulation, as in previous missions. This condition, caused by the phase shifter and, at times, poor antenna orientation during tracking operations, is not significant. Good tracking data were acquired whenever the spacecraft was over a station with the beacons on; however, no usable tracking data were received during the periods when the beacons were turned off.

#### Location Aids

The recovery forces reported that transmissions from all location aids, with the exception of the SEASAVE HF rescue beacon, were satisfactorily received. The SEASAVE beacon was tested after the flight and operated within specification. The reason for this lack of signal reception is believed to be shorting of the recovery antenna. The flashing recovery light was also reported to have stopped operating during the recovery period, but postflight tests to date have revealed no malfunctions in this unit; however, the investigation is continuing.

#### Command Receiver

Although it was not required for flight control during the mission, the command receiver operated normally during the launch and orbital flight phases. Calibration signals for correcting baseline shifts in the instrumentation were satisfactorily received by the spacecraft. However, during the deployment of the drogue parachute, an all-events-channel indication with a signal strength of 3 microvolts was noted. This indication was of no significance to the mission and is believed to have been caused by the planned delay in the deployment of one of the radio antennas.

### Instrumentation System

Performance of the instrumentation system was satisfactory, with but a few minor anomalies, for the MA–8 flight. The system was nearly identical to configurations used during previous orbital missions. Because of the extended duration of this flight, the program for operation of the astronaut observer camera was modified and the thickness of the magnetic recording tape was reduced to provide full mission coverage. Additional changes include the substitution of an impedance pneumograph for the breath-sensing thermistor used in MA–7 to measure the astronaut's respiration and the relocation of the temperature monitoring point for the environmental control system from the steam vents to the domes of the heat exchangers. Finally, an indicator was added to the instrument panel to display oxygen partial pressure in the cabin, and the coolant-quantity-indicator transducer was removed.

While conducting a launch simulation prior to flight, the 108-second timer which terminates the automatic sequence of the blood pressure measuring system (BPMS) failed to operate. Since the BPMS could be stopped manually, prelaunch operations were continued without replacing this unit because of the time involved. Postflight analyses revealed that a faulty switching transistor in the timing circuit was the cause of the malfunction.

On the day prior to launch, the body temperature readout on the high-frequency telemetry channel became slightly noisy, but a decision to continue into the launch countdown was made because the low frequency channel was yielding good data. However, at 6 minutes before lift-off, both channels of the body temperature readout became erratic. A decision to continue with the mission was again made, since the suit-inlet temperature and the astronaut's status report were deemed to be satisfactory. The loss of body temperature measurement continued until just prior to 02:00:00 ground elapsed time (g.e.t.), after which the readings were in the normal range, with some intermitted readings, until completion of the flight. Exhaustive postflight testing has not revealed any malfunctions which would explain the temporary loss of this instrumentation.

During the flight, there were discrepancies between the suit-inlet temperature indications displayed to the astronaut and those transmitted to the ground over the telemetry channels. The ground readout was as much as 8° F higher than that reported by the pilot at times during the flight, and improper calibration and interpretation of the temperature pickup is believed to have been the source of the error. These and other smaller discrepancies are currently under investigation.

Some erratic behavior of the oxygen partial pressure transducer was evident during the mission. For a period of about 15 minutes, beginning at 01:14:00 g.e.t., the partial pressure indications were of no value, and, thereafter, poor quality data for periods of up to 30 seconds were occassionally exhibited. Postflight duplication and analysis of this erratic behavior were not possible because of the expiration of the lifetime of the instrument sensor.

### Life Support System

The life support system primarily controls the suit and spacecraft cabin environments, but the system also includes the food, water, pressure suit, and restraint system for the astronaut. This system performed satisfactorily and was of a configuration similar to those of previous manned orbital flights except for the following notable differences. The molded leg restraints were removed, and only small lateral supports at the knees and toe-and-heel restraints were installed. The manual lockout feature of the cabin pressure relief valve was deleted. Because the mission was extended, it was specified that the cabin leakage rate was not to exceed 600 cc/min before lift-off to conserve cabin oxygen during the flight, and 15 pounds of coolant water were added to the environmental control system (ECS). The final change to the life support system was the inclusion of eight radiation dosimeters, five of which were of a solid-state type installed in the pressure suit and the remaining three versions were self-indicating to permit inflight monitoring by the astronaut.

Although the ECS performed satisfactorily throughout the mission, its cooling performance

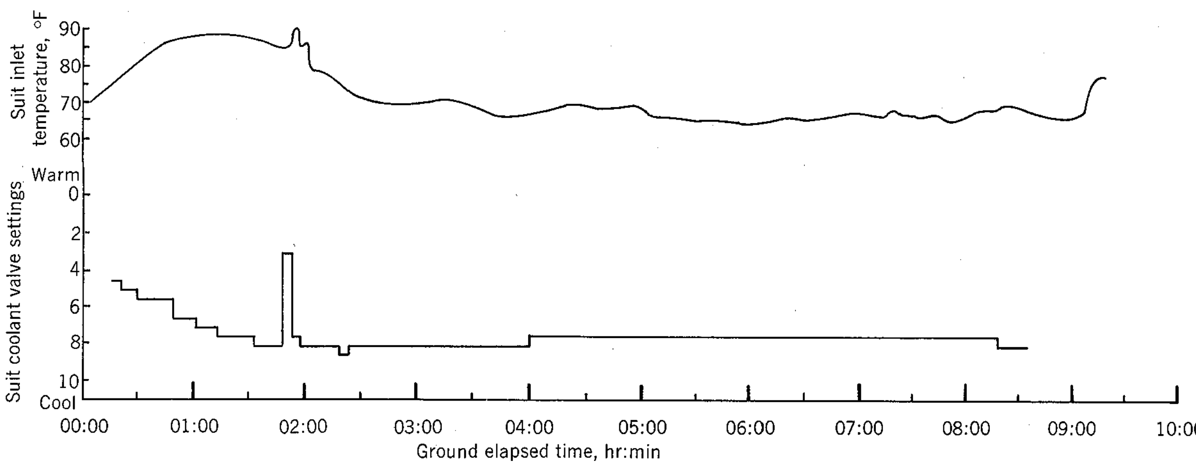


FIGURE 1-6.—Suit-inlet temperature and coolant-control-valve setting.

in the suit circuit was not entirely satisfactory during the first 2 hours after launch. Cooling in the pressure suit was somewhat less than expected after orbital insertion, but a gradual advancement of the coolant control valve (CCV) by the astronaut adequately corrected this situation. The launch setting of 4.0 for the suit-circuit CCV was established from preflight tests, but after this setting proved to be insufficient for proper cooling, subsequent inflight increases in half-position increments were made to a level of 7.5. This increased level of coolant flow resulted in a more satisfactory suit-inlet temperature and was essentially maintained throughout the remainder of the flight as shown in figure 1-6. Postflight tests revealed that dried lubricant had partially blocked the valve orifice and reduced the flow. This reduction in flow shifted the preflight calibration curve so that the CCV setting at launch was no longer valid for proper ECS operation in orbit. Effective monitoring and management of the ESC by the astronaut resulted in satisfactory control of the suit-cooling circuit.

As also experienced during the MA-7 flight, the cabin temperature was slightly above the desired level, but was still well within acceptable ranges. Flight data indicated that the cabin heat exchanger was operating efficiently during the flight. Drifting flight provided the astronaut with the capability to reduce cabin temperature by shutting down heat-producing components. Because of increased heat loads since the original design of the cabin cooling circuit, the temperature levels are now above those initially specified but are considered nominal for this flight.

### Electrical and Sequential Systems

The electrical and sequential systems performed extremely well throughout the MA-8 mission, and only very minor problems were encountered. These systems were essentially unchanged from the MA-6 and MA-7 missions. However, the zener diode panel used on previous flights was removed to eliminate voltage transients, a number of relatively small but significant modifications were made as a result of a single-point failure analysis, and the control barostat used for deploying the landing system in the MA-7 spacecraft was removed. Each of the remaining sets of barostats in the parachute deployment circuit was wired in series for improved reliability.

During the flight, the rate of increase in the operating temperature of the 250 volt-ampere inverter indicated that little or no cooling was present for that unit. The temperatures of this inverter were, however, within acceptable limits and caused no concern on the ground. Postflight tests showed the coolant-flow orifice for this inverter to be partially blocked.

A very brief delay was reported by the astronaut in the ignition of the first retrorocket. Postflight investigation of the sequential ignition circuitry disclosed no malfunctions, and a close examination of the flight data provided verification that the timing unit operated within specification limits. The nominal retrosequence period is $30 \pm 0.5$ seconds in length, and the data show that the corresponding duration for MA–8 did not exceed 30.5 seconds.

### Scientific Experiments

Four scientific experiments were planned for the MA–8 mission which utilized equipment and materials in addition to the normal spacecraft operation. These experiments were a continuation of the program initiated during the MA–6 mission to study the scientific aspects of terrestrial space. The experiments to be discussed include two which required the participation of the astronaut and two which were of a passive nature.

#### Light Visibility Experiment

As in the MA–6 and MA–7 missions, an attempt was made by the astronaut to observe high-intensity light sources at ground-based locations. The objective for this experiment, as in MA–7, was to determine the capability of the astronaut to acquire and observe a ground-based light of known intensity. Another location, in addition to Woomera, Australia, was provided at Durban, South Africa. During the first orbital pass over Woomera, Astronaut Schirra was to acquire visually the light from four flares, each with an intensity of 1 million candlepower. At Durban, he was to observe a xenon light of similar intensity for a period of about 3 minutes during the sixth orbital pass. Both attempts were unsuccessful because of extreme cloud cover. The astronaut reported that, although cloud formations were prevalent around the entire ground track of the orbit, he was able to see lightning in a storm over Woomera and the lights of a city near Durban while conducting the experiment.

#### Photographic Studies

A 70-mm Hasselblad camera with detachable film magazines and filters was used in two studies of photographic and spectral definition of terrestrial surface features. Since a prescribed ground rule of the flight was to conserve control fuel, only a few selected photographs were taken.

The U.S. Weather Bureau sponsored a photographic exercise which involved exposing the film through a special filter mosaic. The purpose of this exercise was to measure the spectral reflectance of clouds, land, and water for application to weather satellites. The filter mosaic, shown in figure 1–7 and described in the following table, consisted of six gelatin plates which were mounted just ahead of the film plane in a special magazine.

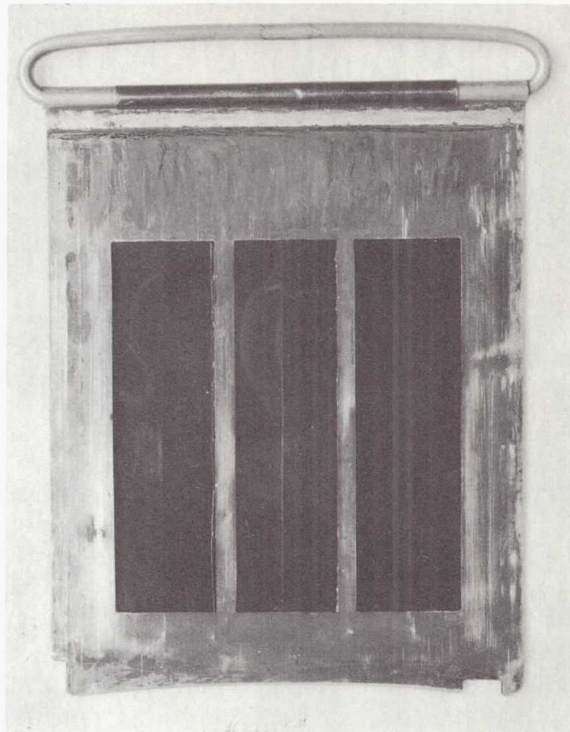

FIGURE 1–7.—Filter mosaic slide.

| Number | Color | Wratten number | Neutral density of W–96 filter |
|---|---|---|---|
| 1 | Blue | W–47B and W–96 | 0.1 |
| 2 | Green | W–61 and W–96 | .1 |
| 3 | Neutral | W–96 | .2 and .9 |
| 4 | Yellow | W–15 and W–96 | .9 |
| 5 | Red | W–25 and W–96 | .6 |
| 6 | Far red | W–70 and W–25 | |

A total of 15 frames were exposed on the U.S. Weather Bureau films by the astronaut, and a preliminary postflight analysis indicated that the yellow and red filters yielded a higher contrast than the other filters, as shown in figure 1–8. Although certain controls were exercised prior to launch, such as measuring the spectral transmittance of the camera lens and spacecraft window, the astronaut reported that, when the escape tower was jettisoned, the exhaust of the rocket left a light residue of

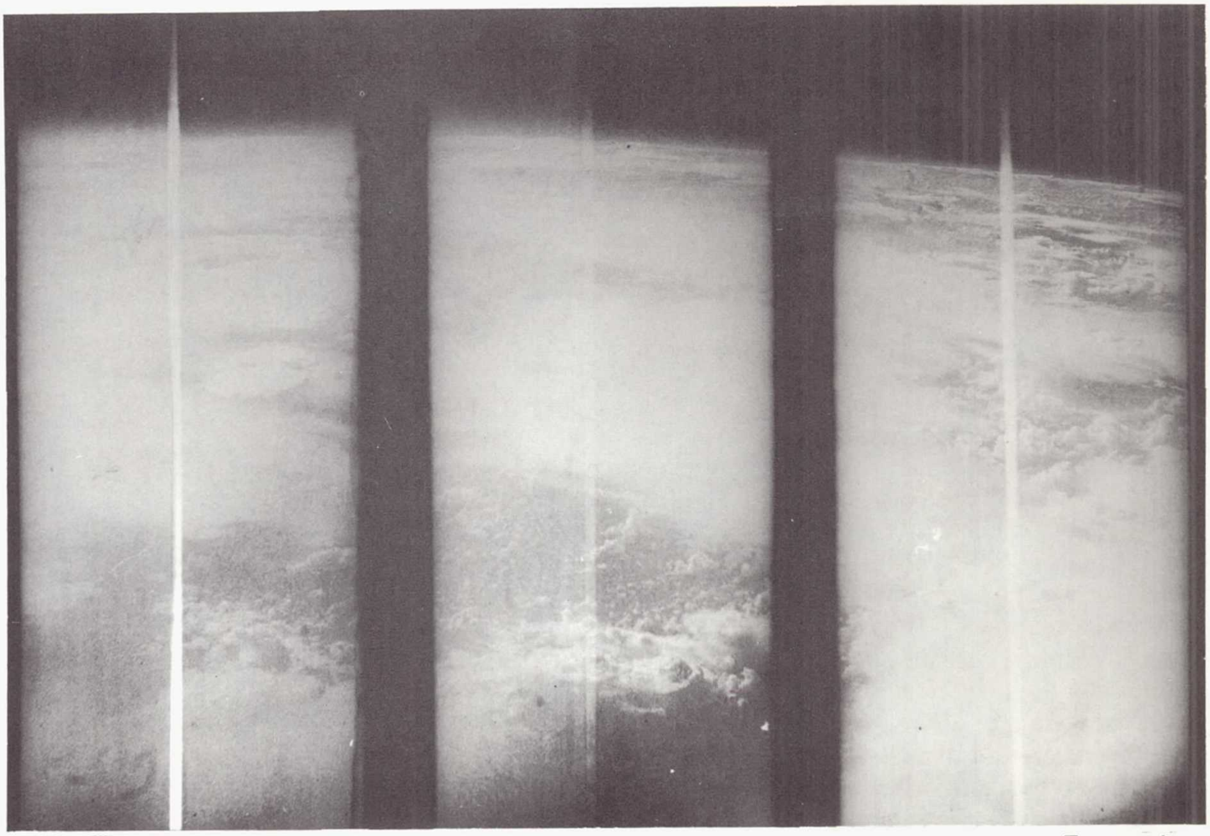


FIGURE 1-8.—Weather photograph showing filter comparison.

indefinable characteristics on the window. An investigation of the effect of this residue on the photographs, a comparison of these photographs with some which were taken on the day of launch by the Tiros satellite, and further analysis of the exposures are being conducted.

A series of terrestrial color photographs were taken by Astronaut Schirra for two purposes: (1) to aid in building up a catalog of space photographs of various physiographic features of the earth, such as folded mountains, fault zones, and volcanic fields; and (2) to obtain photographs of cloud patterns for comparison with those of other satellite programs. An exposure meter was provided the astronaut to aid in the adjustment of the camera. A total of 14 exposures was made over the western United States and Mexico during the third pass and over South America during the sixth pass. Several of these photographs were either overexposed or rendered unusable with regard to physiographic studies because of extensive cloud cover. An analysis of the remaining frames is in progress.

#### Nuclear Radiation Experiment

Two packages of radiation-sensitive emulsions were provided by the NASA Goddard Space Flight Center to study the flux and composition of the galactic cosmic radiation outside the earth's atmosphere. It was also intended that a measurement of the intensity and energy spectrum of artificially induced electrons at orbital altitudes be obtained. The processing of these emulsions consumes an extensive amount of time; however, a preliminary inspection of the plates indicates that valuable data will be derived from both film packages.

In addition to the Goddard emulsion packages, two sets of radiation-sensitive films, which have been included in spacecraft for previous missions, were provided by the U.S. Naval School of Aviation Medicine. These emulsions will also be analyzed to provide a continuing catalog of radiation data for the near-space environment.

### Ablation-Material Investigation

An experiment intended to determine the reentry heating effects on various advanced ablation materials was conducted during the MA-8 mission. These materials are being considered for possible use in the design of vehicles for future space programs. Although many studies of these materials have been conducted in the laboratory, the Mercury mission afforded the opportunity to use much larger test samples under more realistic conditions. A total of eight types of ablation material in nine different configurations was supplied by six organizations. These samples were bonded to the exterior surface of 9 of the 12 beryllium shingles on the cylindrical section of the spacecraft. A preflight photograph of these materials bonded to the shingles is shown in figure 1-9. Two of the uncoated shingles were instrumented with thermocouples, and temperature-sensitive paint was applied to the interior surface of each of the nine experimental shingles. The ablation panels were each 15 inches long and 5 inches wide. Most of the samples contained intentional cutouts to represent repairs and joints in order to determine the effectiveness of modification and restoration techniques for these materials.

A close inspection of the panels following the flight revealed evidence of normal charring and some minor cracking, as expected, but there was no indication that delamination from the beryllium shingles occurred. The ablation panels received little damage during postflight handling, and each of the samples appears to have sustained the reentry heat pulse in excellent fashion. An initial inspection of the areas which had received purposeful repairs shows that they were no more affected by reentry heating than other portions of the ablated surfaces. An analysis of the temperature data and a more detailed investigation of the ablation samples are continuing.

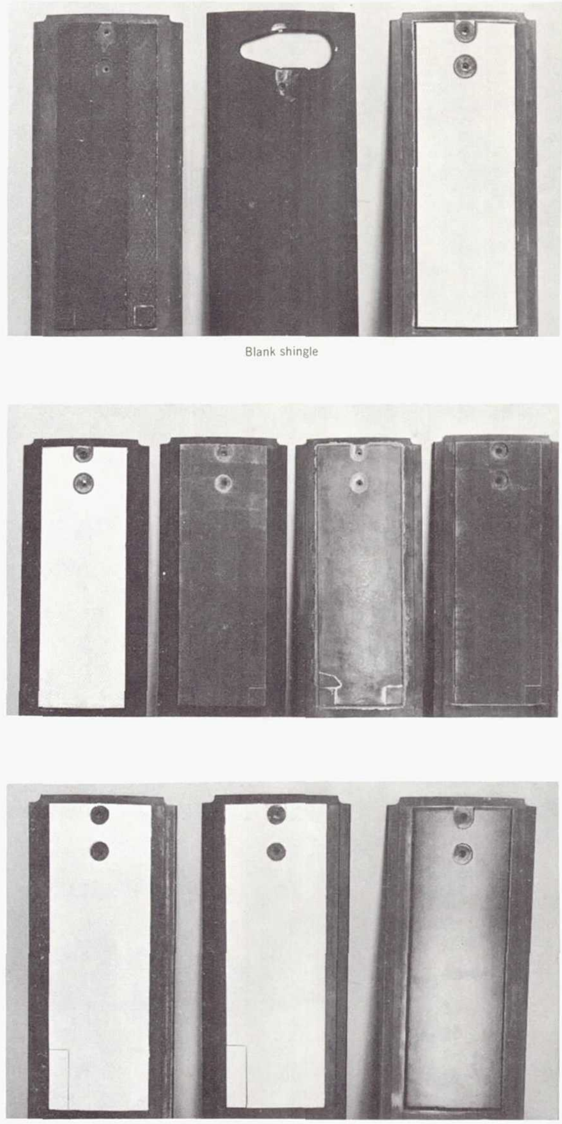


FIGURE 1-9.—Ablation material samples bonded to spacecraft beryllium shingles.

### Launch Vehicle Performance

The Atlas (113 D) launch vehicle which placed Astronaut Schirra and his *Sigma 7* spacecraft into an orbit having a perigee altitude of 100 miles performed exceptionally well. A significant hardware change since the MA-7 mission was included for this flight. The two booster engines were modified to include new baffled fuel injectors which improved the combustion characteristics, and hypergolic igniters were installed in lieu of the pyrotechnic devices previously used. Because of these modifications, the rough combustion cutoff capability and the hold-down delay used in the past to allow for monitoring engine performance immediately after ignition were discontinued. In addition to this change, the insulation bulkhead, which was considered to be unnecessary, was removed at the factory. Finally, the hydraulic lines associated with pressure transducers of the abort sensing system in the thrust section were modified to prevent freezing, a condition believed to have existed during MA–7 (see ref. 2).

All launch vehicle systems performed satisfactorily, and only two minor anomalies occurred which should be noted. The trajectory of the launch vehicle prior to booster engine cutoff was somewhat lofted, and this condition resulted in an early staging of the booster engines and a late sustainer engine cutoff (SECO). In addition, a slight overspeed condition of 15 feet per second at insertion resulted in the apogee altitude of the orbit being about 8.6 nautical miles greater than nominal. The guidance system operated within specification, and all guidance parameters were acceptable during the go—no-go computation immediately after SECO.

A small clockwise roll transient occurred immediatly after lift-off, and this roll rate probably was caused by a slight misalinement of the booster engines and thrust from the gas generator exhaust. The magnitude of the roll transient was less than the abort threshold value, and the condition was satisfactorily corrected by the vernier engines of the launch vehicle.

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# 2. MISSION OPERATIONS

By JOHN D. HODGE, *Asst. Chief for Flight Control, Flight Operations Division;*
EUGENE F. KRANZ, *Flight Operations Division;*
and JOHN STONESIFER, *Flight Operations Division*

**Summary**

A discussion of the detailed operational support provided during the MA–8 mission, including the prelaunch, launch, orbital, and recovery phases, is presented. Because the prelaunch preparation and the launch countdown for the spacecraft and launch vehicle were nearly identical to that performed for the first two U.S. manned orbital missions, these activities are given only minor emphasis. The launch phase proceeded almost perfectly, except for a brief hold of 15 minutes' duration which occurred at T–45 minutes for repairs to the Canary Islands radar. The countdown continued thereafter without difficulty. The powered flight phase was normal, and the spacecraft was inserted into a nominal orbit. The flight was satisfactorily monitored by personnel located at ground stations around the Mercury network, and their activities are presented chronologically. The only flight discrepancy which caused concern was a suit-cooling problem during the first orbital pass. The astronaut corrected this problem by gradually increasing the flow of coolant water to the suit heat exchanger. The mission continued normally after the suit temperature had reached a more satisfactory value, and the astronaut's management of the onboard systems was excellent. The astronaut used the automatic stabilization and control system to perform successfully the retrofire and reentry maneuvers. Initial computations using flight data at retrofire indicated that the landing point would be very close to the recovery aircraft carrier, the U.S.S. *Kearsarge*. The spacecraft was observed visually during descent on the main parachute and, after landing about 4 nautical miles from the carrier, was placed aboard ship in approximately 40 minutes.

**Introduction**

In the present paper, the flight control and recovery operations for the MA–8 mission are discussed in detail. Since the launch support procedure was discussed in reference 1, it will only be mentioned briefly. A very limited number of changes in the operational support from the two previous missions was made. Most of these changes were instituted in anticipation of longer duration missions after MA–8. Based on the extended mission for MA–8, the recovery support was grouped in a general area south of Bermuda and a second support activity was provided near Midway Island in the Pacific Ocean. The flight plan differed significantly from those of the two previous missions, primarily because of the greater emphasis placed on the engineering aspects of the flight. Most of the flight activities conducted during the mission were designed to establish greater confidence in the operation of spacecraft systems for longer duration missions, to provide a detailed check of the long-term operating characteristics of the automatic stabilization and control system (ASCS), and to determine if the spacecraft window would provide an adequate yaw reference under all conditions.

**Prelaunch Activities**

During the prelaunch period, a total of 7 days were spent in conducting simulation exercises. Two days were utilized in conducting launch simulations with the Mercury Control Center and Bermuda flight control teams and the astronauts in attendance. One day was spent in performing four reentry simulations, which involved the Canton, Hawaii, California, Guaymas, and Mercury Control Center stations. These simulations were conducted in an effort to familiarize the personnel at these stations with reentry decision techniques and retrosequence procedures when faced with various spacecraft systems problems. Three full network simulations were performed in fast time. The fast-time procedure primarily consisted of a real-time mission from lift-off to a ground elapsed time (g.e.t.) of 03:20:00. At this time, the computers used in the simulations were fast-timed until 07:10:00 g.e.t. when the mission was resumed in real time.

The flight control teams at the majority of the network stations included one or two new personnel, and all simulations were profitable in providing detailed training in network operations for these new flight controllers. A high level of performance was demonstrated by the flight control teams very early in the schedule. The flight controllers maintained this performance level throughout all of the remaining network simulations and during the actual MA–8 mission.

The countdown for launching the Mercury-Atlas vehicle is conducted in two parts. The first part, lasting approximately 4 hours, was conducted on October 2, 1962, and was completed satisfactorily. The second part of the countdown was initiated after the detailed hydrogen peroxide surveillance test, and the flight control team joined the spacecraft and launch vehicle countdown at approximately T–3 hours. The astronaut was suited (see fig. 2–1) and transported to the launch complex for insertion into the spacecraft. The countdown continued normally until T–45 minutes, at which time the Canary Islands radar unit became temporarily inoperative because of a driver-unit failure, and the countdown was interrupted for 15 minutes to allow repair of this unit. The Canary Islands station is important during the initial phases of the mission, primarily because it is the first network station to establish radar contact after sustainer engine cut-off. The resulting data provide an early confirmation of the orbital insertion conditions and trajectory. In the case of marginal cut-off conditions, the Canary Islands radar data provide enough information concerning the orbital capability to make any necessary go—no-go decision at the end of the first orbital pass. With this unit inoperative, the decision from a later station regarding orbit capability would become time critical. After resuming the countdown at T–45 minutes, no further holds were experienced, and all systems were "go" during the remainder of the period prior to lift-off.

FIGURE 2–1.—Astronaut Schirra being suited prior to launch.

### Powered Flight Phase

Lift-off occurred at 7:15:11 a.m., e.s.t., on October 3, 1962, and the powered flight phase was monitored routinely. The quality of the air-ground (A/G) communications was reduced somewhat by the increased background noise near staging; however, it improved rapidly and was satisfactory during the remainder of powered flight. Throughout this phase, the astronaut was able to make all the communications and observations indicated in the flight plan. The "go" capability, as indicated by the computers at the Goddard Space Flight Center, was confirmed and transmitted rapidly to the astronaut at 00:05:44 g.e.t.

Table 2–I presents the actual cut-off conditions, orbital parameters, and maximum conditions that were obtained. A comparison of the planned and actual times at which major events occurred is given in table 2–II.

### Orbital Flight Phase

After separation of the spacecraft from the launch vehicle, the astronaut was given all pertinent data regarding orbit parameters and necessary retrosequence times. As in the MA–7 mission, the Bermuda voice-remoting facility (see ref. 2) was utilized to extend the communications capability of the Capsule Communicator (Cap Com) in the Mercury Control Center.

*Table 2–I.—Actual Flight Conditions*

| | |
|---|---|
| Cut-off conditions: | |
| Altitude, ft | 528, 467 |
| Space-fixed velocity, ft/sec | 25, 730 |
| Space-fixed flight-path angle, deg | −0. 0062 |
| Orbital parameters: | |
| Perigee altitude, nautical miles | 86. 94 |
| Apogee altitude, nautical miles | 152. 8 |
| Period, min:sec | 88:55 |
| Inclination angle, deg | 32. 55 |
| Maximum conditions: | |
| Exit acceleration, g units | 8. 1 |
| Exit dynamic pressure,[a] lb/sq ft | 964 |
| Reentry acceleration, g units | 7. 6 |
| Reentry dynamic pressure, lb/sq ft | 458 |

[a] Based on atmosphere at Cape Canaveral.

From the A/G voice communications and summary messages received from network stations during the early portion of the first orbital pass, it became readily apparent that the suit-cooling system was not as effective as had been expected. The suit temperature, as indicated by telemetry, appeared to have increased from a value of 74° F at lift-off to a value of 90° F over the Muchea station. The suit-heat-exchanger dome temperature, a new parameter for this mission, remained at approximately 80° during this period. The astronaut had gradually increased the suit coolant valve setting to a scribe mark of approximately 7.5, which was almost twice the level of 4 established for lift-off. During most of the orbital phase, the onboard instrumentation indicated suit inlet temperatures from 6° to 10° less than values read out on the ground from telemetry. In most instances, flight controllers relied upon telemetered values during the first orbital pass. Consideration was given to terminating the flight at the end of the first orbital pass because of the elevated suit temperature. The environmental monitor at the MCC believed that the system should have been operating satisfactorily within the first hour and that the intended level of suit cooling might never be achieved. However, during the period between passes over Muchea and Canton, the ground readout of suit-inlet

*Table 2–II.—Sequence of Events*

| Event | Preflight predicted time, hr:min:sec | Actual time, hr:min:sec |
|---|---|---|
| Launch phase | | |
| Booster engine cut-off (BECO) | 00:02:10. 8 | 00:02:08. 6 |
| Tower release | 00:02:33. 8 | 00:02:33 |
| Escape rocket ignition | 00:02:33. 8 | 00:02:33 |
| Sustainer engine cut-off (SECO) | | 00:05:15. 7 |
| Tail-off complete | 00:05:05. 8 | 00:15:15. 9 |
| Orbital phase | | |
| Spacecraft separation | 00:05:06. 8 | 00:05:17. 9 |
| Retrofire sequence initiation | 08:50:21. 8 | 08:51:30 |
| Retrorocket (left) no. 1 | 08:50:51. 8 | 08:52:00 |
| Retrorocket (bottom) no. 2 | 08:50:56. 8 | 08:52:05 |
| Retrorocket (right) no. 3 | 08:51:01. 8 | 08:52:10 |
| Retrorocket assembly jettison | 08:51:51. 8 | 08:53:00 |
| Reentry phase | | |
| 0.05g relay | 09:00:20. 8 | 09:01:40 |
| Drogue parachute deployment | 09:05:36. 8 | 09:06:50 |
| Main parachute deployment | 09:07:02. 8 | 09:08:12 |
| Main parachute jettison (water landing) | 09:11:33. 8 | 09:13:11 |

temperature had begun to stabilize and indicated a tendency to decrease. The flight surgeon at the MCC was also concerned with the elevated temperature, especially since the body temperature instrumentation was at that time inoperative. But, since other aeromedical data and voice reports indicated that the astronaut was in good condition, the flight surgeon believed that it would be safe to continue for another orbital pass. All other systems performed extremely well throughout the first orbital pass. The correlation between attitudes observed visually through the window and the readouts of the spacecraft gyros and the horizon scanners was good. This excellent performance continued throughout the remainder of the mission. The spacecraft was controlled by the ASCS in orbit mode throughout the first pass, except for brief periods when the astronaut used the fly-by-wire (FBW) mode, low thrusters only.

Because the suit-inlet temperature had apparently leveled off and the possibility that it had started to decrease late in the first pass, the flight director decided to continue the flight for at least one additional orbital pass in order to allow the suit cooling system more time to stabilize. Upon contact with Guaymas, the astronaut reported that he was feeling warm, but not uncomfortable, and that the suit-cooling system had apparently begun to function properly. He stated that all of the systems were performing perfectly, and the telemetry readouts on the ground confirmed this observation. Over Woomera on the second orbital pass, the suit temperature had decreased to a value of 72° F and remained in the area of 67° to 72° F, as reported by the astronaut, for the remainder of the mission.

Fuel management during the entire flight was exceptionally good. The spacecraft fuel tanks had been filled to capacity, and at the end of the first pass, the gages for both the automatic- and manual-system fuel supply tanks indicated that there was approximately 98 percent remaining. In the majority of the cases where maneuvers were conducted over network stations, the fuel usage was so slight that it was difficult to determine if fuel was being consumed at all. The fuel usage in both the automatic and manual systems was significantly less than had been estimated based on the flight plan. Oxygen consumption was almost exactly as it had been estimated prior to launch. The cabin air temperature remained reasonably constant, as evidenced by its operating range of 105° to 110° F. The 150 v-amp inverter temperature increased slowly to a value of about 110° F, and the temperature of the 250 v-amp inverter climbed gradually to a value of approximately 150° F until the power to the ASCS was turned off early in the fourth orbital pass. At this time, the temperature dropped steadily to a value of approximately 120° F within one orbital period, at the end of which the ASCS was again turned on. The 250 v-amp inverter temperature again increased gradually at a similar rate to a value of 180° F at completion of the flight.

Minor difficulties occurred in the biological instrumentation system; the primary problem was the failure of the body temperature measuring system to read correctly on the ground during the early portion of the flight. However, over the Indian Ocean Ship during the second pass, the temperature readout was regained and continued to indicate a value between 97.7° F and 98.5° F throughout the remainder of the flight. The blood-pressure instrumentation had displayed minor difficulties prior to flight, in that the automatic timer used to conclude the measurement cycle had failed. The astronaut was therefore required to use the manual stop button to terminate each measurement cycle.

Activities during the first orbital pass were primarily devoted to ASCS checks. Also, the manual proportional and the FBW, low, control modes were checked, and the high-frequency voice system was exercised. After receiving the go—no-go decision at the end of the first pass, the astronaut performed a series of maneuvers designed to test his ability to aline the spacecraft about the yaw axis during the daylight phase. These yaw checks were entirely satisfactory, and the astronaut reported that he was able to determine a day yaw reference very accurately. After completion of the yaw checks at approximately 02:00:00 g.e.t., the astronaut selected the manual proportional control mode and began limited drifting flight within the limits of the horizon scanners. At approximately 02:20:00 g.e.t., the astronaut began a series of yaw checks on the night side, again using the FBW low, mode. He reported that these yaw checks were also satisfactory.

A minor clock error of +1 second continued throughout the second orbital pass. There was some indication that the error was very gradually increasing. At the end of the flight, a +5-second error, which is still within specified limits, was evident in the clock. This error was routinely compensated for in the retrosequence time transmitted to the astronaut.

After having received the decision to continue into the third orbital pass, the astronaut turned off the power to the control system and the radar beacons and began attitude-free drifting flight at approximately 03:10:00 g.e.t. The powering down sequence was considered to be normal by the MCC, and the astronaut maintained the spacecraft in this configuration until the pass over the Indian Ocean Ship. The astronaut completed a power-up exercise over this station and all systems operated normally throughout the remainder of the third orbital pass.

Prior to lift-off, the retrosequence setting in the spacecraft clock for a retrofire during the sixth pass was set at a nominal value of 08:50:31 g.e.t. based upon nominal cutoff conditions. The astronaut was instructed to increase this setting by about 1 minute when the spacecraft passed over the Cape Canaveral site during the third pass because of the overspeed condition at cut-off. At the end of the third orbital pass, the astronaut again powered down the spacecraft systems, began attitude-free drifting flight, and remained in this flight mode throughout the fourth pass. At the end of the fourth orbital pass, the fuel quantity indicators read 86 percent for the automatic system and 90 percent for the manual system. The clock during this period had increased to 3 seconds, and the suit temperature was stabilized at a value of approximately 70°F. The cabin temperature during the third and fourth orbital passes indicated a decrease to approximately 90°F, and all other systems appeared to be functioning normally.

Throughout the fifth orbital pass, the astronaut mainly used the ASCS mode of control, and good correlation was maintained between the gyro attitude readouts and the horizon scanner outputs. The spacecraft-to-ground voice communications were somewhat inferior to those experienced during the previous flight; however, most of the stations were able to communicate during their preestablished contact period. Patching of the A/G voice communications into the Goddard conference loop was not as efficient as had been expected. In addition, the majority of the stations from the Pacific Command Ship to Kano were affected by the transition from daytime to nighttime frequencies. During the fifth pass, the Mercury Control Center was unable to communicate with the Indian Ocean and Pacific Command Ships in order to relay the decision to continue into the sixth orbital pass. The Cap Com aboard the Pacific Ship and the astronaut apparently had made this decision independently, and, as a result, the mission continued through the fifth pass and into the sixth.

During the fifth pass, Hawaii relayed the correct end-of-mission retrosequence time of 08:51:28 g.e.t., which was based upon the latest orbital trajectory data and the final estimated weight loss. This time did not include the +5-second clock error that was currently apparent. The clock was corrected to include this error over the California station, and the correction was confirmed by Guaymas. Thus, the final and correct clock setting was established as 08:51:33 spacecraft elapsed time.

The mission continued normally as the spacecraft passed over the remaining two stations during the sixth orbital pass. The Cap Com aboard the Indian Ocean Ship assisted the astronaut in completing his preretrosequence checklist. These communications were monitored by personnel throughout the network over the Goddard conference loop. Voice communications to both the Indian Ocean and Pacific Command Ships were acceptable at this time, and, as a result, the Mercury Control Center was able to monitor activities during retrosequence. Retrosequence was initiated by the spacecraft clock at approximately 08:51:28 g.e.t. Retrofire was initiated at approximately 08:52:00, as observed in Mercury Control Center; but this time appeared to be about 2 seconds late. The attitudes at retrofire were nominal and remained constant to within ±2° during the entire retrofire interval.

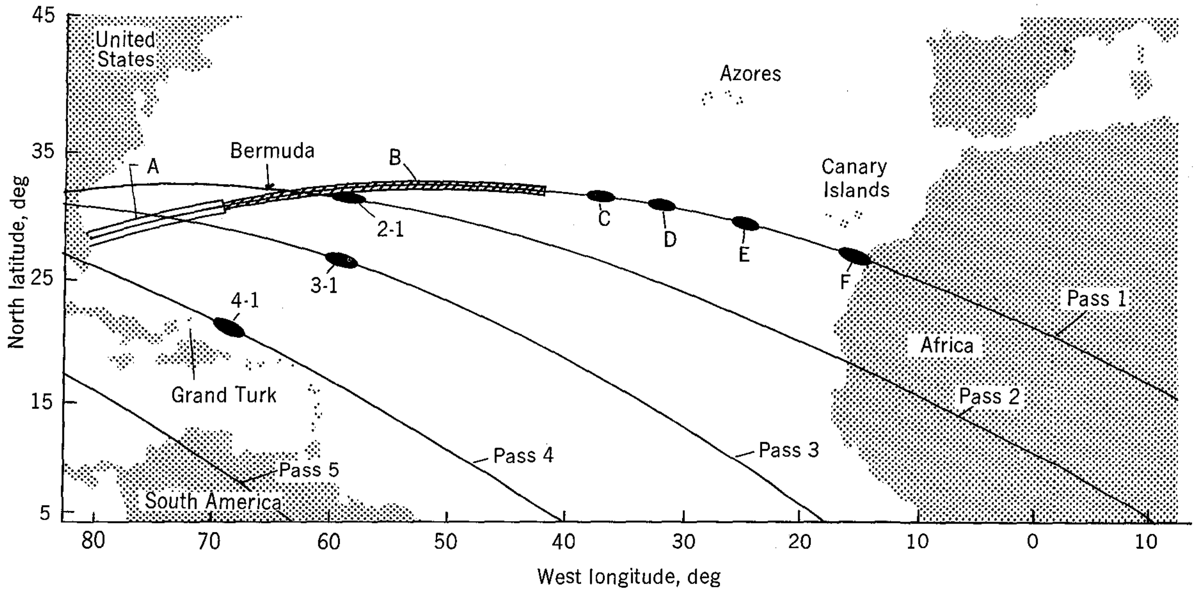
### Reentry Phase

The astronaut reported that the spacecraft attitude, as observed visually, remained constant at the desired values and that the retropackage had jettisoned automatically at 08:53:00 g.e.t. The retraction of the periscope and orientation of the spacecraft to reentry attitude occurred on time. The fuel quantity indicators at the completion of retrofire showed the fuel remaining to be 68 percent in the automatic system and 84 percent in the manual system. Although the reentry trajectory is normally computed by Goddard based upon nominal conditions at retrofire, the Goddard computers were prepared at this time to receive the telemetered retrofire parameters in order to process the final landing-point computation. This computation is based upon the known time of retrofire, the telemetered spacecraft attitudes, and the estimated weight of the spacecraft. Other than voice communications with the astronaut and limited telemetry information received from the Watertown radar ship, no further trajectory data were obtained. The Watertown Cap Com gave the MCC an ionization blackout time which confirmed the initial reentry trajectory computation. The final predicted trajectory submitted by Goddard indicated a nominal spacecraft landing about 4 nautical miles from the primary landing point. A report from the carrier that the spacecraft had been sighted visually before landing provided final confirmation of the computed predictions. The communications relayed from the spacecraft by aircraft in the primary recovery area to the Hawaii station were extremely effective and provided communications with the astronaut almost continuously from the end of blackout until landing. These communications gave the Mercury Control Center and the entire network confidence that the mission had been terminated satisfactorily. Because of the excellent performance of the astronaut and spacecraft, the flight-control task during the second through the sixth orbital passes became one of the monitoring, gathering data, and assisting the astronaut in his completion of the flight plan. After the decision to continue the flight at the end of the first orbital pass, the remaining end-of-orbit decisions were made without hestitation, with the one exception previously mentioned regarding the loss of communications between Mercury Control Center and the Pacific Command and Indian Ocean Ships during the fifth pass. The operations conducted during the entire MA-8 mission made maximum use of experience gained in previous missions, and, as a result, was the best coordinated effort of the Mercury program to date.

### Recovery Operations

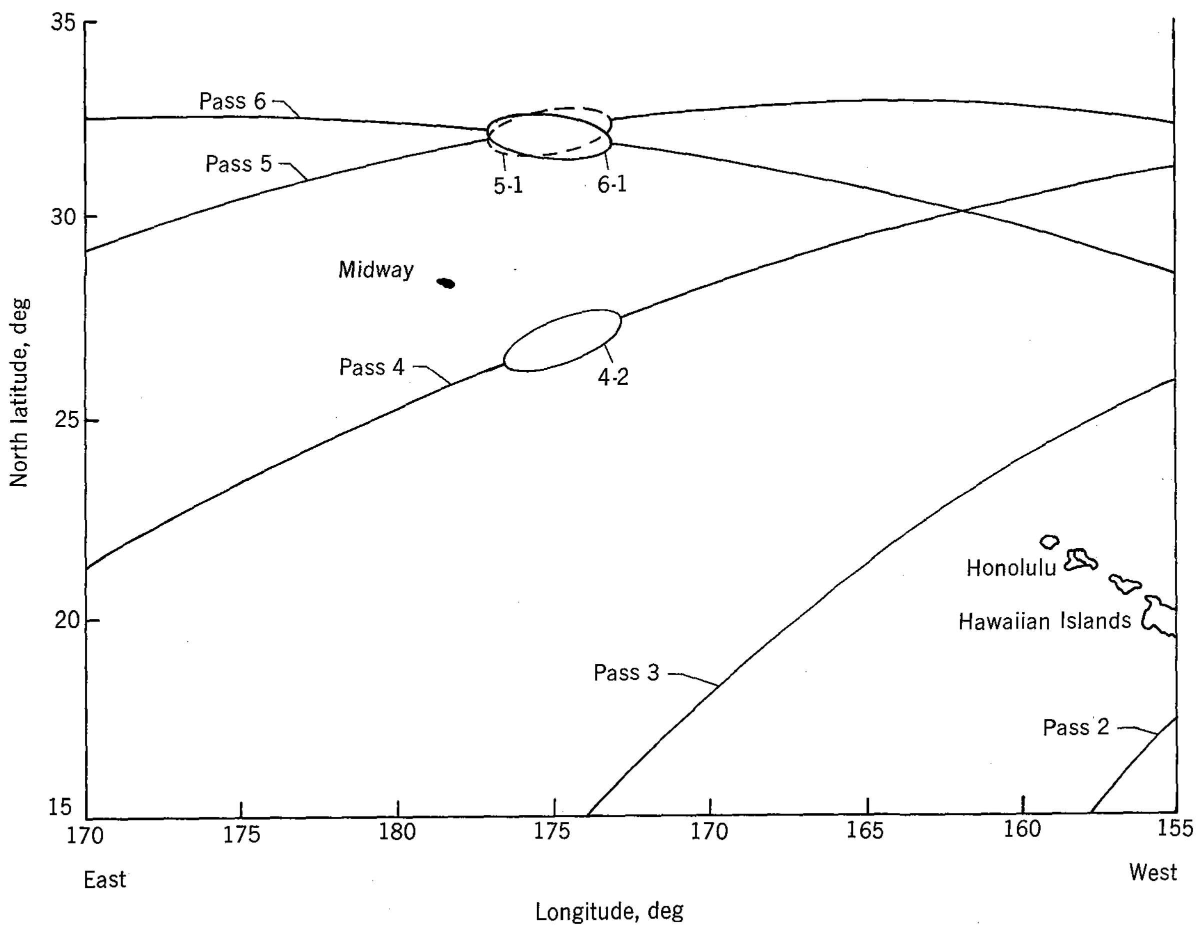
Disposition of recovery forces for the MA-8 mission was very similar to that for the MA-6 and MA-7 missions. In addition, there were three planned landing areas in the Pacific Ocean to provide for landings from orbital flight during the fourth, fifth, and sixth orbital passes. The planned landing areas in the Atlantic Ocean were essentially unchanged from the two previous missions. As shown in figure 2-2(a) these areas were located to provide recovery capability during aborts from powered flight and for landing at the end of each of the first three orbital passes. The locations of the planned landing areas in the Pacific are indicated in figure 2-2(b). Area 6-1 was the primary planned landing area. Recovery support was positioned in this area to provide for location and retrieval within 3 hours of landing. The disposition of the recovery forces positioned in the planned landing areas is indicated in table 2-III. The positions of all recovery forces were not static, in that certain ships and aircraft were required to provide recovery capability for more than one landing area during the course of the mission. As in MA-6 and MA-7, special aircraft were on alert at various staging bases in the event of a contingency landing at any point along the orbital ground track. These aircraft were positioned and equipped to locate the spacecraft within a maximum of 18 hours from landing and render pararescue assistance if required.

All recovery forces were in their planned positions at the appropriate times. Weather forecasts on the morning of October 2, 1962, indicated that Hurricane Daisy might be in a position to cause unfavorable recovery conditions in area 3-1. Therefore, the recovery ships in this area were relocated along the ground track approximately 215 nautical miles downrange from their corresponding original stations. At launch time, weather conditions were favorable for satisfactory location and retrieval of the spacecraft in all planned Atlantic and Pacific recovery areas, including those designated in case of a contingency landing. Although some redundant transmissions were not received, recovery communications were satisfac-




(a) Atlantic Ocean.

FIGURE 2-2.—Planned landing areas.




(b) Pacific Ocean.

FIGURE 2-2.—Concluded.

*Table 2–III.—Recovery Forces in Planned Landing Areas*

| Area | Number of search aircraft | Number of helicopters | Number of ships | Alloted access time, hr |
|---|---|---|---|---|
| Launch site | 0 | 3 | 0 | Short |
| A | 2 | 0 | 3 destroyers | 6 |
| B | 3 | 0 | 3 destroyers | 9 |
| C, E, F | 1 | 0 | 1 destroyer | 6 |
| D | 1 | 0 | 1 oiler | 3 |
| 2–1, 3–1 | [a] 2 | 0 | 2 destroyers | 3 |
| 4–1 | 2 | 3 | 1 carrier<br>1 destroyer | 3 |
| 4–2 | [b] 4 | 0 | 3 destroyers | 3 |
| 5–1, 6–1 | 4 | 3 | 1 carrier<br>3 destroyers | 3 |
| Total | 17 | 9 | 23 | |

[a] Two area B search aircraft deployed to area 2–1 after spacecraft passage of area B.
[b] Area 4–2 search aircraft deployed to areas 5–1 and 6–1 after spacecraft passage of area 4–2.

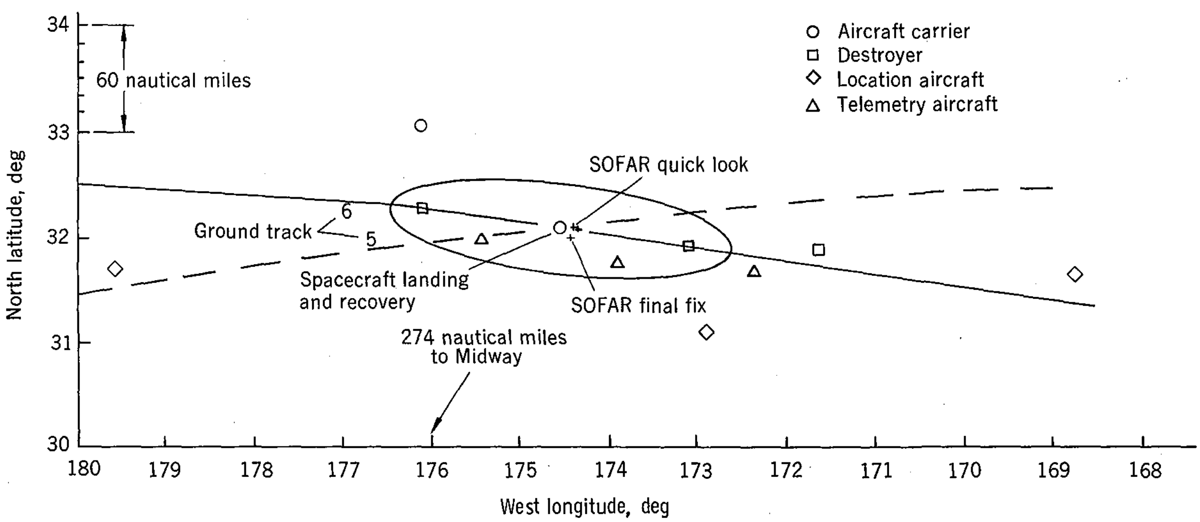



Figure 2–3.—Landing area details.

tory throughout the operation, and the recovery forces were given information regarding mission status during the launch, orbital, and reentry phases.

During the sixth orbital pass, recovery units in area 6–1 were alerted to expect a landing in their area. After retrofire maneuver at about 20 minutes prior to landing, recovery forces were informed that the retrorockets had operated normally, and the landing position was predicted to be nominal. Recovery units in area 6–1 made contact with the descending spacecraft before any calculated landing predictions, based on reentry tracking, were available from network support. Details of the recovery events in the landing area are shown in figure 2–3. The U.S.S. *Kearsarge*, the aircraft carrier positioned in the center of area 6–1, established radar contact with the spacecraft at a slant range of about 175 nautical miles and maintained this contact until the spacecraft had descended to an altitude of approximately 1,200 feet. Lookouts aboard the U.S.S. *Renshaw*, the destroyer positioned 80 nautical miles uprange from the center of the area, reported that they had heard the noise caused by the shockwave of the spacecraft during reentry. A few minutes after the "sonic boom" occurred, lookouts using optical aids on the recovery carrier reported having first sighted

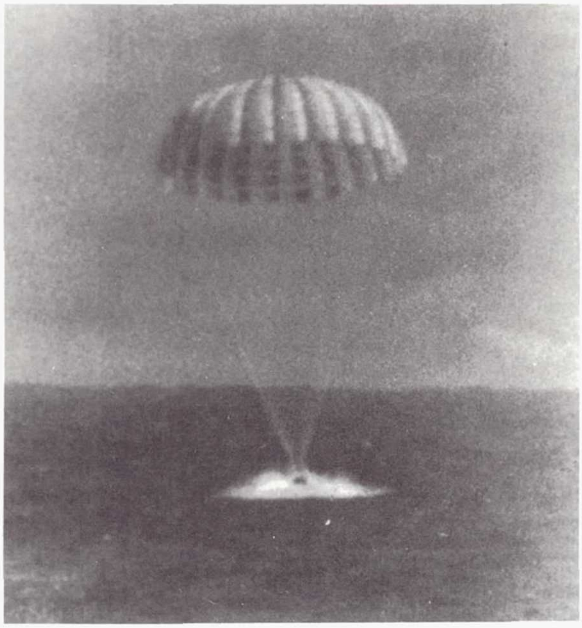


FIGURE 2-4.—Spacecraft landing.

FIGURE 2-5.—Motor whaleboat attaching lifting line to the spacecraft.

FIGURE 2-6.—Spacecraft being lowered to the deck.

FIGURE 2-7.—Astronaut Schirra egressing from spacecraft.

a contrail and then the spacecraft after drogue parachute deployment. Main parachute deployment and spacecraft descent and landing were observed to be about 4 nautical miles downrange from the U.S.S. *Kearsarge* (see fig. 2-4). In addition to visual sightings of the descending spacecraft by ship personnel, the search aircraft reported contact with the spacecraft recovery beacons at ranges of 60 to 280 nautical miles. The SOFAR bomb signal was received by the hydrophone net in the Pacific Ocean, and a "quick look" location fix was provided as a result of this reception 20 minutes after spacecraft landing. The final location fix from the SOFAR bomb signal was provided 45 minutes after landing. Both of these fixes were within 2 miles of the actual spacecraft retrieval position (fig. 2-3).

After landing, the astronaut reported that conditions were normal, that he was comfortable, and that the spacecraft was dry inside and floating upright. Helicopters launched from the U.S.S. *Kearsarge* dropped a team of three frogmen who installed an auxiliary flotation collar around the spacecraft. At this time, the astronaut reported he preferred to remain in the spacecraft and be retrieved by the recovery ship. As the carrier approached the spacecraft, a motor whaleboat towed a lifting line to the spacecraft, as shown in figure 2–5, and attached it to the recovery loop atop the spacecraft. The spacecraft was then hauled to a position beneath the U.S.S. *Kearsarge* boat crane, lifted clear of the water, and positioned on one of the carrier's elevators at approximately 40 minutes after landing. Figure 2–6 shows the spacecraft being lowered to the elevator. After spacecraft positioning on deck, Astronaut Schirra opened the explosive-actuated side hatch and egressed from the spacecraft (fig. 2–7). He remained onboard the U.S.S. *Kearsarge* (see fig. 2–8) throughout a period of about 72 hours and participated in medical and engineering debriefings. The spacecraft was transferred to an airplane at Midway Island for return to Cape Canaveral, Fla.

FIGURE 2–8.—Astronaut Schirra aboard the recovery carrier.

## Reference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# 3. AEROMEDICAL ANALYSIS

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## Summary

Astronaut Walter M. Schirra, Jr., incurred no detectable physiologic decrement during his space flight which included over 9 hours of weightlessness. His body functions since the flight have remained normal and unchanged from their healthy preflight condition. A variation of the astronaut's instantaneously observed heart rate response was noted during flight. Immediately following recovery, an orthostatic rise in heart rate accompanied by a fall in systolic blood pressure was observed for a brief period. Inflight ionizing-radiation monitoring showed that the astronaut sustained no significant exposure.

## Introduction

The aeromedical findings obtained during the MA–8 mission amplified those resulting from previous manned space flights (refs. 1 to 9). The astronaut's state of health and his medical fitness for space flight were continuously evaluated during his preflight preparation. These accumulated data served to familiarize the aeromedical flight controllers with the astronaut's normal physiological responses and also provided a baseline with which to compare inflight and postflight findings. These preflight, inflight, and postflight medical findings are presented chronologically in this paper. The preflight and flight chronologies are subdivided into two classifications, clinical examinations and physiological observations. The postflight findings are grouped into an aeromedical history and physical examinations. Finally, a series of special studies for the MA–8 mission are presented.

The spacecraft environment materially affects the pilot's physiological responses; thus, the discussion of the environmental control system performance in the Life Support System section of paper 1 complements the physiological observations presented herein.

## Preflight

### Clinical Examinations

The clinical examinations of the astronaut consisted of aeromedical histories, physical examinations, clinical laboratory tests, X-rays, an electrocardiogram (ECG), an electroencephalogram (EEG), and an audiogram.

*Aeromedical history.*—Astronaut Schirra spent most of the time from June 1962 to the launch date of October 3, 1962, at Cape Canaveral, Fla., in preparation for the MA–8 mission. During this period, he chose swimming and water skiing for preflight physical conditioning. In the several days immediately prior to flight, he did not undertake direct physical conditioning. A controlled diet which provided a balanced menu was begun on September 21, 1962. A low-residue diet was followed, as planned, for the 3 days before flight. The menu for meals included in the low-residue diet is presented in table 3–I. Astronaut Schirra reported minimal difficulty in becoming accustomed to this diet. All of the 325-cc fluid intake on the morning of launch, from awakening to lift-off, occurred at breakfast and consisted mostly of orange juice. Astronaut Schirra reported that shortly before lift-off, he was aware of an emptiness in his stomach and the possibility occurred to him that he might become nauseated during the flight. This

*Table 3–I.—Low-Residue Diet*

| | September 30, 1962 | October 1, 1962 | October 2, 1962 | October 3, 1962 |
|---|---|---|---|---|
| Breakfast | 9:00 a.m.<br>Grapefruit juice<br>Cream of rice<br>Scrambled eggs<br>Canadian bacon<br>Toast, butter<br>Jelly<br>Coffee | 6:15 a.m.<br>Orange juice<br>Baked egg, bacon<br>Toast, butter<br>Jelly<br>Coffee | 6:30 a.m.<br>Orange-grapefruit juice<br>Cream of rice<br>Soft cooked egg<br>Canadian bacon<br>Toast, butter<br>Jelly<br>Coffee | 2:10 a.m.<br>Orange juice<br>Scrambled eggs<br>Fish<br>Steak<br>Toast, butter<br>Jelly<br>Coffee |
| Lunch | ---------- | 12:00 noon<br>Tomato juice<br>Noodles with veal<br>Cottage cheese<br>Melba toast<br>Butter<br>Pound cake and apricots<br>Tea and coffee | 11:30 a.m.<br>Chicken noodle soup<br>Meat loaf on toast<br>Peas<br>Sherbet<br>Coffee and tea | |
| Dinner | 4:00 p.m.<br>Shrimp cocktail<br>Crackers<br>Baked chicken<br>Rice, peas<br>Hard rolls, butter<br>Sherbet, cookies<br>Coffee and tea | 5:00 p.m.<br>Consomme, crackers<br>Steak<br>Potato, green peas<br>Hard rolls, butter<br>Jello<br>Coffee and tea | 5:30 p.m.<br>Pineapple juice<br>Roast beef<br>Baked potato<br>Wax beans<br>Hard roll, butter<br>Angel food cake and peaches<br>Coffee and tea | |

sensation is attributed simply to the fact that he had not eaten for 5 hours. During the 155-minute period after his insertion into the spacecraft and prior to launch, he voided three times into the urine collection device.

The MA–8 aeromedical countdown differed from those of previous orbital flights only in the times alloted for each activity and the time when the pilot was awakened on launch day. A comparison with the countdowns of previous orbital missions is provided in table 3–II. Such changes reflect not only operational requirements to complete certain tasks, but also represent an effort to provide the pilot with a maximum amount of sleep prior to the mission. He obtained 5 hours of sound sleep immediately before the mission. No medication was given.

*Physical examinations.*—Abbreviated physical examinations were conducted by the MA–8 Crew Flight Surgeon prior to each of the preflight activities listed in table 3–III. A somewhat more extensive examination was conducted 15 days prior to flight. Also, a comprehensive medical evaluation was accom-

*Table 3–II.—Aeromedical Countdown Summary*

[All times are e.s.t.]

| | MA–6 | MA–7 | MA–8 |
|---|---|---|---|
| Pilot awakened | 2:20 a.m. | 1:15 a.m. | 1:40 a.m. |
| Nominal launch | 8:00 a.m. | 7:00 a.m. | 7:00 a.m. |
| Time to nominal launch, hr:min | 5:40 | 5:45 | 5:20 |
| Actual launch | 9:47 a.m. | 7:45 a.m. | 7:15 a.m. |
| Time to actual launch, hr:min | 7:27 | 6:30 | 5:35 |

*Table 3–III.—Abbreviated Preflight Activities*

| Date | Activity |
|---|---|
| September 1962: | |
| 10 | Simulated flight, suited and with sensors |
| 13 | Simulated flight, suited and with sensors |
| 15 | Procedures trainer, MCC, suited |
| 18 | Medical evaluation |
| 20 | Procedures trainer, MCC, suited |
| 21 | Began controlled diet |
| 28 | Launch simulation, suited and with sensors |
| 29 | Simulated flight, unsuited |
| 30 | Began low-residue diet |
| October 1962: | |
| 1 | Comprehensive medical evaluation |
| 3 | Aeromedical countdown, flight, postrecovery examination |
| 4 and 5 | Aeromedical and engineering debriefing |
| 6 | Departure from debriefing site |
| 9 | Return to Cape Canaveral |

plished by a team of specialists 2 days before the flight. This evaluation included an audiogram, a chest X-ray, and an electrocardiogram. An electroencephalogram accomplished on May 17, 1962, was deemed adequate for purposes of comparison with the postflight electroencephalogram and was not repeated before the flight. All of these medical evaluations (tables 3–IV to 3–VI) revealed a healthy and alert pilot, fit for his flight assignment.

#### Physiological Observations

The physiological observations are based on data from the sensors on the pilot and sensors of the spacecraft environment. Physiological data for Astronaut Schirra covering a total observation time of 23 hours and 27 minutes were obtained from the following sources:

1. Dynamic tests (treadmill, tilt table, and cold pressor) conducted at the Lovelace Clinic, Albuquerque, New Mexico, in March 1959.
2. The Mercury-Atlas three-orbital pass simulation conducted at the U.S. Naval Aviation Medical Acceleration Laboratory (AMAL) in Johnsville, Pennsylvania, on September 22, 1961.
3. A simulated flight on May 4, 1962, conducted at the launch complex at Cape Canaveral as a part of the MA–7 prelaunch preparation.

*Table 3–IV.—Clinical Evaluation*
[All times are e.s.t., October 3, 1962]

| | Preflight at Cape Canaveral 2:46 a.m. ([a]) | Postflight onboard the aircraft carrier 6:05 p.m. ([b]) |
|---|---|---|
| Temperature (oral), °F | 97.6 | 99.4 |
| Pulse rate, beats/min | 64 (supine) | 92 (sitting) |
| Blood pressure, left arm, mm Hg | 120/78 (supine)<br>122/85 (standing) | 118/78 (sitting) |
| Respiratory rate, breaths/min | 14 | |
| Weight (nude, bladder empty), lb | 176¾ | 172¼ |
| Comments | Hematoma, right inguinal region; otherwise no abnormalities, including ECG, audiogram, and chest X-rays performed October 1, 1962. | Abrasions of right knuckles; pressure points over both acromial processes; and orthrostasis. Otherwise normal. |

[a] Unchanged from the several other preflight examinations.
[b] Repeated examination on October 4, 1962, did not reveal orthrostasis abrasions and pressure points were resolving. Complete examination of October 1, 1962, was repeated on October 4 and 5, 1962; no significant change was detected.

*Table 3–V.—Peripheral Blood Values*

| Determination | Preflight | Postlanding | | | |
|---|---|---|---|---|---|
| | −15½ hr | +1½ hr | +5 hr | +14½ hr | +51 hr |
| Hemoglobin (Cyanmethemoglobin method), grams/100 ml | 15.0 | ---------- | 14.5 | 15 | 14.7 |
| Hematocrit, percent | 44 | 47 | 45 | 46 | 43 |
| Red blood cells, millions/mm³ | 5.0 | ---------- | 4.7 | 4.8 | 4.6 |
| White blood cells/mm³ | 9,800 | ---------- | 10,350 | 8,400 | 9,400 |
| Differential blood count: | | | | | |
| Lymphocytes, percent | 34 | ---------- | 31 | 49 | 47 |
| Neutrophiles, percent | 62 | ---------- | 63 | 46 | 51 |
| Monocytes, percent | 3 | ---------- | 4 | 3 | 1 |
| Eosinophiles, percent | 1 | ---------- | 2 | 2 | 1 |
| Basophiles, percent | 0 | ---------- | 0 | 0 | 0 |
| Platelets/mm³ | adequate | ---------- | adequate | 274,000 | 294,000 |
| Sodium, mEq/l | 152 | 150 | 147 | 145 | 145 |
| Potassium, mEq/l | 3.9 | 4.1 | 3.9 | 3.8 | 4.3 |
| Chloride, mEq/l | 102 | 108 | 107 | 103 | 104 |
| Calcium, mEq/l | 5.2 | 5.9 | 5.6 | 5.2 | 5.1 |
| Protein (total), g/100ml | 8.0 | 8.0 | 7.0 | 8.1 | 7.0 |

4. Simulated flights conducted with the spacecraft in the altitude chamber at Cape Canaveral on April 17, 1962, and with the spacecraft at sea level on August 14, 1962.
5. Simulated flights on September 10 and 14, 1962, and a simulated launch on September 28, 1962, all of which were conducted at the launch complex.
6. Records obtained from the biosensor checkout in the hangar, in the transfer van, and from the blockhouse during the launch countdown on October 3, 1962.

*Biosensor system.*—The Mercury biosensor system for this mission consisted of two sets of electrocardiographic (ECG) leads, a rectal temperature thermistor, an impedance pneumograph, and the blood-pressure measuring system (BPMS). Reports of the results for previous missions (for example, ref. 8) contain most of the details of the biosensor system. Changes to this system for the MA–8 mission were as follows: The ECG electrode on the right lateral chest midaxillary line was moved slightly lower to minimize muscle artifact. The ECG electrodes were affixed to the skin with a double-backed adhesive tape, such as that used for a colostomy, and this tape was fitted to the rubber ring of the sensor. The sensor paste was changed from the previously used bentonite-calcium chloride compound to a combination of carboxypolymethylene and Ringer's solution. Carboxypolymethylene is a hygroscopic, polymerized carrier for the ions needed to provide electrical continuity, is more soluble, and is easier to work with than the bentonite paste. The 10-times-isotonic Ringer's solution not only retained the necessary conductivity and low impedance required, but also afforded decreased skin irritation after prolonged contact.

Considerable study and detailed evaluation of the BPMS after the MA–7 mission demonstrated a definite need to change the criteria for adjusting the amplification of the sounds picked up by the microphone, which is located over the brachial artery. These sounds should correspond to those heard with a clinical stethoscope during cuff pressure decay if an accurate interpretation of BPMS data is to be achieved. Repeated comparisons of clinical blood-pressure readings with those obtained using the BPMS allowed determination of an optimum controller gain setting specifically for the flight astronaut. To provide more freedom in the pressure suit,

*Table 3–VI.—Urine Summary*

| Determination | Preflight | Inflight | Postlanding | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | −1 day | | +6 hr | +17½ hr | +23 hr | +50 hr | +53 hr | +56½ hr | +61 hr | +63 hr | +69 hr |
| Volume, cc | ---------- | ([a]) | 233 | 323 | 150 | 440 | 460 | 410 | 850 | 125 | 375 |
| Specific gravity | 1. 010 | 1. 010 | 1. 018 | 1. 021 | 1. 021 | 1. 013 | 1. 010 | 1. 014 | 1. 020 | | |
| Osmolarity, milliosmoles | 593 | 595 | 848 | 995 | 951 | 442 | 266 | 609 | 262 | 301 | 568 |
| pH | 6. 0 | Acid | Acid | Acid | Acid | 6. 0 | 7. 0 | 6. 0 | | | |
| Albumin, glucose, ketones, bile | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sodium, mEq/l | 103 | 86 | 107 | 47 | 54 | 69 | 62 | 112 | 35 | 19 | 66 |
| Potassium, mEq/l | 47 | 49 | 58 | 46 | 69 | 34 | 18 | 38 | 14 | 19 | 59 |
| Chloride, mEq/l | 127 | 106 | 103 | 47 | 93 | 62 | 32 | 70 | 24 | 24 | 91 |
| Calcium, mEq/l | 8. 5 | 6. 1 | 4. 8 | 8. 4 | 8. 4 | 7. 0 | 2. 9 | 4. 0 | 2. 2 | 1. 6 | 3. 1 |
| Microscopic examination (High power field). | Occasional white blood cells; few squamous cells | -------- | 4 to 5 white blood cells; occasional red blood cells; mucuous threads rare granular cast, some epithelial threads | Occasional white blood cells; occasional epithelial cell, no red blood cells | Occasional white blood cells; amorphous sediment | 3 to 6 white blood cells; minimal mucuous | Occasional white blood cells | Occasional white blood cells | | | |

[a] Most of the inflight specimen was lost into the Mercury pressure suit. A total of 292 cc was recovered.

the thickness of the BPMS cuff was decreased without change in bladder size. The diameter of the hose leading from the cuff to the suit connection was also decreased. The microphone, cuff, and controller were all fitted and calibrated specifically for Astronaut Schirra. These changes did not affect the cuff filling or bleed-down times, and the basic design of the BPMS system was unchanged.

During preflight testing at the launch complex, the BPMS automatic timer failed. This failure made it necessary for the astronaut to depress the manual stop button at cycle completion in order to return the telemetry signal from BPMS to ECG II. This method of manual operation was used throughout the flight.

The body-temperature instrumentation failed 6 minutes before launch, with the readout going to full scale. At approximately the middle of the second orbital pass, a nominal value reappeared, but thereafter the signal was somewhat intermittent.

The respiratory trace was obtained by measuring transthoracic impedance which is directly proportional to thoracic volume. The variation of thoracic impedance correlates well with spirometer data, although the correlation is not linear. The impedance pneumograph system consists of a 50-kc oscillator, a 50-kc amplifier, a detector, and a low-frequency amplifier. The output of the oscillator is applied across the chest by electrodes in each midaxillary line at the level of the subject's sixth rib. These electrodes, the conductive paste, and the methods of attachment are identical to the ECG electrode system previously described. The oscillator output is varied by means of a potentiometer so that the inspiratory peaks remain on scale on the direct writing recorder except during exceptionally deep breathing. Even when the range is exceeded, respiratory rate can still be determined unless it is accompanied by excessive body movement. Body movements of the pilot can make the respiratory trace difficult to interpret, but the inherent restrictions on such movement of the spacecraft design keep motion artifact to a minimum. The unit does not indicate instantaneous tidal volume, but it does provide a general trend of changes in chest volume. Inspiration is distinguishable even during the thoracic volume changes that occur with speaking.

*Baseline data.*—Baseline physiological data were obtained during the preflight activities listed in table 3–VII. This table also summarizes all available data on heart rate and respiration rate. The rates from the dynamic simulation at the Johnsville AMAL were determined by counting for 30 seconds during each minute. Other heart and respiratory rates were obtained by counting for 30 seconds every 3 minutes. Rates for the final 10 minutes of the MA–8 launch countdown were determined by counting for 30 seconds every minute. The mean prelaunch heart and respiration rates were similar to those obtained during other procedures, and all values were within physiologically acceptable limits. Preflight body temperatures ranged from 97.0°F to 97.9°F until the signal failed.

Examination of the ECG waveforms during prelaunch activities showed sinus arrhythmia, infrequent premature atrial contractions, and rare premature ventricular contractions. During the actual launch countdown, a single premature atrial contraction occurred.

Blood-pressure data are summarized in table 3–VIII. The values for the "Special BPMS Test" of July 25, 1962, were collected from a series of comparisons of BPMS readings with those obtained using the standard clinical technique. These values were obtained early in the astronaut's preflight preparation period to determine at an early date the proper gain adjustment of the BPMS amplifier. Random clinical determinations were obtained from routine annual physical examinations and from examinations associated with various prelaunch activities. The preflight clinical values and BPMS readings are similar and represent normal physiological responses.

## Flight Responses

### Clinical Evaluation

Data for the inflight clinical evaluation are obtained from the voice transmissions of the aeromedical monitors and postflight debriefing queries. It is, in the strictest sense, not the usual clinical evaluation, because the telemetered physiological responses serve as a substitute for a normal physical examination.

Despite the increase of 4½ hours in the duration of weightlessness above that experienced in each of the two previous manned

*Table 3–VII.—Summary of Heart Rate and Respiration Data From Physiological Monitoring*

| Date | Procedure | Duration of observation, hr:min | Heart rate, beats/min | | | | Respiration rate, breaths/min | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Number of determinations | Standard deviations, $2\sigma$ | Range | Mean | Number of determinations | Standard deviations, $2\sigma$ | Range | Mean |
| **Preflight** | | | | | | | | | | |
| March 1959 | Lovelace Clinic dynamic tests. | Variable | 39 | ([a]) | 68 to 160 | 96 | None Recorded | | | |
| September 22, 1961 | Mercury-Atlas Centrifuge dynamic simulation. | 1:07.5 | 75 | 50 to 78 | 48 to 78 | 64 | 25 | 9 to 15 | 7 to 18 | 12 |
| May 4, 1962 | MA–7 launch-pad simulated flight. | 1:09 | 24 | 53 to 91 | 58 to 88 | 72 | 19 | 10 to 22 | 10 to 24 | 16 |
| April 17 and August 14, 1962. | Hangar simulated flights | 9:47 | 87 | 52 to 78 | 51 to 76 | 65 | 19 | 14 to 26 | 14 to 24 | 20 |
| September 10, 1962 | Launch pad simulated flight 1A. | 3:09 | 69 | 45 to 65 | 43 to 72 | 55 | 68 | 14 to 26 | 10 to 28 | 20 |
| September 14, 1962 | Launch pad simulated flight 2A. | 2:35 | 68 | 54 to 82 | 52 to 86 | 68 | 68 | 14 to 30 | 12 to 28 | 22 |
| September 28, 1962 | Launch pad simulated launch. | 3:07 | 72 | 49 to 73 | 46 to 74 | 61 | 71 | 12 to 28 | 9 to 26 | 20 |
| October 3, 1962 | Launch countdown | 2:33 | 61 | 64 to 80 | 58 to 88 | 72 | 61 | 17 to 23 | 16 to 26 | 20 |
| **Inflight** | | | | | | | | | | |
| October 3, 1962 | Inflight | 9:13 | 220 | 50 to 102 | 56 to 121 | 76 | 220 | 11 to 27 | 10 to 43 | 19 |
| **Postflight, clinical** | | | | | | | | | | |
| October 3 and 4, 1962 | Debriefing onboard recovery ship. | Variable | 22 | 52 to 112 | 56 to 104 | 82 | None Recorded | | | |

[a] These data are included for completeness, but the conditions were very different from the other procedures.

TABLE 3-VIII.—*Summary of Blood-Pressure Data*

| Date | Procedure | Mean blood pressure, mm Hg | Systole | | | | Diastole | | | | Mean pulse pressure, mm Hg |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Number of determinations | Standard deviation, $2\sigma$ | Range, mm Hg | Mean, mm Hg | Number of determinations | Standard deviation, $2\sigma$ | Range, mm Hg | Mean, mm Hg | |
| Preflight, clinical | | | | | | | | | | | |
| March 1959 | Lovelace Clinic dynamic tests. | 119/67 | 39 | ([a]) | 90 to 164 | 119 | 39 | ([a]) | 52 to 84 | 67 | 52 |
| July 25, 1962 | Special BPMS test. | 104/75 | 27 | 92 to 116 | 94 to 116 | 104 | 27 | 62 to 88 | 64 to 94 | 75 | 29 |
| 1960 to October 3, 1962. | Random clinical determinations. | 115/76 | 13 | 103 to 127 | 100 to 122 | 115 | 13 | 62 to 90 | 64 to 84 | 76 | 39 |
| Preflight, BPMS | | | | | | | | | | | |
| September 22, 1961. | Mercury-Atlas dynamic simulation on centrifuge. | 133/96 | 11 | 111 to 155 | 115 to 150 | 133 | 11 | 68 to 124 | 76 to 120 | 96 | 37 |
| July 25, 1962 | Special BPMS test. | 108/67 | 28 | ([a]) | 94 to 126 | 108 | 28 | ([a]) | 54 to 100 | 67 | 41 |
| May to October, 1962. | Hangar and launch complex tests. | 107/70 | 31 | 92 to 122 | 94 to 123 | 107 | 29 | 58 to 82 | 58 to 80 | 70 | 37 |
| October 3, 1962 | Prelaunch (hangar, transfer van, and blockhouse). | 117/80 | 14 | 103 to 121 | 110 to 143 | 117 | 14 | 66 to 94 | 71 to 94 | 80 | 37 |
| Inflight, BPMS | | | | | | | | | | | |
| October 3, 1962 | Inflight | 126/69 | 20 | 116 to 136 | 111 to 158 | 126 | 16 | 64 to 74 | 59 to 75 | 69 | 57 |
| Postflight, clinical | | | | | | | | | | | |
| October 3 and 4, 1962. | Debriefing onboard carrier. | 112/78 | 12 | 92 to 132 | 94 to 120 | 112 | 12 | 70 to 86 | 70 to 84 | 78 | 37 |

[a] These data are included for completeness but the conditions were very different from the other procedures.

orbital space flights, no untoward sensations were reported by Astronaut Schirra, and the assigned inflight tasks were performed without difficulty. Specifically, he was not nauseated and did not vomit. Although the astronaut was never hungry during the flight, he ate the contents of two tubes containing food, one of peaches and the other of beef with vegetables, without difficulty. He experienced no urge to defecate during the mission, but he did report a moderate amount of inflight flatulence unaccompanied by eructation. Vision and hearing were normal. Astronaut Schirra moved his head as required by his scheduled tasks during the weightless period, including times when the spacecraft was in attitude-free drifting flight, but he experienced no vestibular disturbance or disorientation. The noise and vibration of powered flight were not considered abnormally stressful.

During the flight the pilot drank about 500 cc of water. He urinated three times before lift-off and three times during the flight, the last time just before retrofire. Bladder sensation and function were reported to be normal. Unfortunately, on landing, the urine collection device failed at its attachment to the body and all but 292 cc of the urine was lost.

A few minor problems were encountered. Astronaut Schirra was unable to reach some of the items in the special equipment storage kit located near his right shoulder. This inaccessibility resulted not only from the usual restrictions in motion imposed by the restraint harnesses and suit, but also because the equipment kit had been located nearer the right shoulder for this mission. Consequently, he was unable to evaluate certain items as planned. He also discovered that many items in the equipment kit were covered excessively with Velcro and were, therefore, difficult to remove from stowage. Velcro is a cloth having two different but mutually adhesive surfaces.

During the fourth or fifth orbital pass, a fluid was deposited onto the left inner surface of the helmet faceplate. This fluid obscured the pilot's vision to some degree and forced him to turn his head more than usual to look through the remaining area of the visor that was clear. A postflight analysis proved that this fluid was perspiration.

The astronaut stated he was warm and perspired moderately during the first orbital pass when he was subjected to an elevated suit-inlet temperature. However, he said he was not uncomfortably hot during this period. Medical evaluation of telemetered data during this period indicated that the astronaut was physiologically capable of continuing the flight. The astronaut believed he would be able to control the suit-inlet temperature during the next pass and did so, even to the extent of becoming

*Table* 3–IX.—*Results of Orientation Test*

| Ground elapsed time, hr:min | Target | Result | Error |
|---|---|---|---|
| 03:15 | Manual fuel lever<br>Yaw attitude indicator<br>Emergency rate lever | Manual fuel lever<br>Rivet above clock in 10:30 position<br>Emergency rate lever | None<br>1½ inches down and right<br>None |
| 05:19 | Manual fuel lever<br>Yaw attitude indicator<br>Emergency rate lever | Right of manual fuel lever<br>270° mark on yaw attitude indicator<br>Emergency rate lever | 2 inches right<br>¾ inches left of center of instrument<br>None |
| 08:21 | Manual fuel lever<br>Yaw attitude indicator<br>Emergency rate lever | Manual fuel lever<br>20° mark on yaw attitude indicator<br>Side of hand hit box for emergency rate lever. Index finger was on target | None<br>½ inch right of center of instrument<br>None |

"a little cool" during the fifth and sixth passes. Otherwise, he was comfortable throughout the flight.

Weightlessness was described as "very pleasant," but there was no exhilaration, euphoria, breakoff phenomenon, or other unusual psychological reaction.

During this flight, in addition to utilizing programed times for self-evaluation of orientation to his environment, Astronaut Schirra performed a specific test of orientation. At three different times, he closed his eyes and attempted to touch each of three instruments with his index finger. Results were recorded on the onboard tape and are summarized in table 3–IX. The results show that, in nine attempts, the pilot made five "direct hits" and four "near misses," which included a maximum error of 2 inches. These errors are scattered, but suggest that the third test was the most accurate. Astronaut Schirra concluded that his performance improved with practice and that he performed equally as well during flight as he had done in the Mercury procedures trainer.

Astronaut Schirra developed slight nasal congestion during the final two orbital passes. This congestion caused no difficulty in clearing his ears and did not affect normal respiration. About 4 hours after recovery, he developed mild rhinorrhea which completely disappeared by the next day.

**Physiological Observations**

The total inflight bioinstrumentation monitoring time was 9 hours and 12 minutes. In addition to the continuous records of biosensor data recorded on board, information was obtained through reports from the aeromedical flight controllers around the Mercury network, voice reports by the pilot, and, after the flight, from the film exposed in the pilot-observer camera.

The inflight physiological responses are summarized in tables 3–VII and 3–VIII. Heart rates in beats per minute were obtained by counting 30 seconds of each minute from lift-off to 10 minutes ground elapsed time (g.e.t.), and from 08:48 to 09:13 g.e.t. Values for the remainder of the flight were obtained from 30-second counts every 3 minutes. Biosensor disconnect occurred at approximately 09:13 g.e.t. The mean inflight heart and respiratory rates are not significantly different from the mean preflight values. The maximum heart rate during the launch phase was 112 beats per minute, with a minimum of 102 beats per minute. The maximum heart rate during the orbital phase was 121 beats per minute which occurred just after orbital insertion. Thereafter, it gradually declined, with the slowest rate being 56 beats per minute. During reentry, the maximum heart rate was 104 beats per minute. These responses are within expected physiological ranges.

Careful observation of the ECG reveals frequent variations of the R-wave to R-wave intervals, indicative of an increase and slowing of heart rate. These variations were apparently unrelated to physical activity, and their magnitude was greater than Astronaut Schirra's normal sinus arrhythmia. The reason for this phenomenon, most marked from the fourth to the last orbital pass, is unknown.

The maximum respiratory rate during powered flight of 37 breaths per minute was observed just prior to insertion into orbit when the pilot was experiencing maximum launch acceleration. During weightless flight, respiration rates were close to the mean value. During reentry at 09:05 g.e.t., the respiration rate reached a maximum of 43 breaths per minute and was coincident with maximum reentry acceleration. Thereafter, the rate declined to 20 breaths per minute at biosensor disconnect. These values are also within anticipated physiological ranges.

As shown in table 3–VIII, a total of 20 BPMS cycles were obtained at random intervals throughout the flight. The systolic levels were easily distinguishable for all 20 cycles. Since the automatic BPMS timer was not functioning, premature cutoff of the BPMS signal by the astronaut made four of the diastolic points questionable, and these values are absent from the tabular data. All of the values which were observed during the flight are considered to be normal for Astronaut Schirra. The mean pulse pressure of 57 mm Hg does not represent a physiologically significant elevation from the other values.

Examination of the ECG trace during flight showed no change from the pilot's preflight waveforms. One premature atrial beat, one premature ventricular beat, and one fusion beat were the only variants noted in the more than 9 hours of continuous ECG monitoring.

During the initial portion of the flight, the body-temperature values were unreadable, but they suddenly returned to normal physiologic levels at 01:52 g.e.t. as shown in table 3–X. During the remainder of the flight, the values ranged from 97.7°F to 98.5°F with occasional sudden small changes. These later values are normal, but their accuracy is questionable since proper operation of the system cannot be verified following the period of full-scale readings.

*Table 3–X.—Inflight Body Temperature Values*

| Ground elapsed time, hr:min | Value, ° F |
|---|---|
| 00:00 to 01:52 | Off scale |
| 01:52 to 02:16 | 98.5 |
| 02:16 to 04:05 | 98.3 to 98.5 |
| 04:05 to 05:24 | 97. 7 |
| 05:24 to 09:12 | 98 |

## Postflight

### Aeromedical History

The astronaut was first seen by a physician 40 minutes after landing and immediately following hatch opening. He appeared active, cheerful, and well coordinated. He egressed from the spacecraft onto the carrier deck requiring no assistance. There was no evidence of deterioration of gait or dizziness at any time following the flight. He expressed great pleasure at the way the flight had gone with such expressions as "I feel fine" and "It was a textbook flight." He did not appear unusually fatigued, and was eager to talk.

Following the initial medical examination after recovery, the pilot went to his cabin where he ate a hearty meal. He was still eager to talk and maintained his usual cheerful sense of humor. He retired for the night after a busy day of 21 hours and 40 minutes. After 10 hours of sound sleep, he awoke, urinated, talked, read, and smoked for about an hour. He then returned to bed and slept for 3 additional hours. He appeared well rested and had no apparent residual fatigue from the flight.

### Physical Examinations

The immediate preflight and postflight clinical examinations were accomplished as close together as time permitted in order to maximize detection of any physical changes resulting from the flight. The postflight physical examination and medical debriefing differed from those of previous flights in several important aspects. Since recovery was accomplished in the Pacific Ocean, the entire medical debriefing was carried out aboard the recovery ship, the U.S.S. *Kearsarge.* The landing of the spacecraft within visibility of the recovery carrier permitted not only an early recovery, but also a very early postflight medical examination of the astronaut by an NASA flight surgeon. For previous missions, it was not possible for a flight surgeon specifically from the NASA and familiar with the pilot's medical history to reach the astronaut so soon.

In less than 1 hour after landing, the physical examination was well underway. Oral temperature was 99.4°F, rectal temperature was 100.1° F, blood pressure (left arm, sitting) was 118/78 mm Hg., and the pulse rate was 92 beats per minute and regular. The pilot's skin was warm and dry, but he showed little other evidence of dehydration. His weight loss was only 4½±¼ pounds in spite of the fact that he ate and drank very little during the flight. From the Mercury pressure suit and the urine collection device, 292 cc of urine were recovered, and this sample showed a specific gravity of 1.010. The specific gravity of his urine rose to 1.018 within a few hours after recovery, and the highest value of 1.021 occurred approximately 12 hours after recovery. The 24-hour period following flight showed a fluid intake of 2,580 cc and a fluid loss of 775 cc. The pilot's hematocrit rose from a preflight value of 44 percent to an immediate postflight level of 47 percent. Twenty-eight hours later, it was 46 percent and dropped to 43 percent in another 24 hours. The laboratory findings are summarized in tables 3–V and 3–VI. These values, coupled with the findings during physical examinations, indicate that dehydration of the astronaut was inconsequential during the flight.

Careful examination of the areas of sensor placement revealed slightly reddened areas resulting from pressure, but no irritation from either tape or electrolyte paste was evident. Two small abrasions were noted over the proximal knuckle of the fifth finger of Astronaut Schirra's right hand. These abrasions were sustained when the plunger of the explosive actuator for the egress hatch recoiled against the pilot's gloved hand, and they occurred in spite of his specific effort to avoid this injury. This injury is nearly identical to the one received by Astronaut Glenn during a similar egress from the MA–6 spacecraft. The MR–4 mission was the only other instance where a hatch of the same configuration was actuated. However, no such physical injury was sustained by Astronaut Grissom. Astronaut Schirra also had a reddened area at the shoulders over each acromial process resulting from pressure applied by the couch. This reddening apparently resulted from muscle-tensing exercises conducted during the flight in which he braced his feet on the footboard, his shoulders against the upper portion of the couch, and tensed his back and leg muscles.

A complete physical examination revealed only one finding which is thought to be significant. It was noted that Astronaut Schirra had an increased lability of blood pressure and pulse with changes in body position. When supine, the heart rate averaged about 70 beats per minute, but this value immediately increased to 100 or greater when he stood erect. Blood pressure showed a less dramatic, but still significant, drop in systolic pressure when changing from the supine to the upright position. The reverse was true when he changed positions from standing to supine. There was no apparent change in the diastolic pressure.

In addition, it was noted immediately after the flight that all dependent leg veins were engorged. The feet and legs rapidly took on a dusky, reddish-purple color following standing. Astronaut Schirra commented that these color changes were more noticeable than any he had previously observed.

All these findings persisted up to the time the astronaut retired for the night. The next morning, about 21 hours after landing, examination revealed no orthostatic changes.

At no time did the pilot complain of dizziness, lightheadedness, or other symptoms of orthostatic hypotension. He did, however, offer the information that he had felt lightheaded upon egress from the couch in the procedures trainer following 4 hours of lying supine in the Mercury pressure suit under normal gravity conditions. It is impossible with presently available data to isolate the true effect of human exposure to 9 hours of weightlessness as it relates to hemodynamics. This phenomenon will be closely studied in future orbital flights.

The aeromedical debriefing team, composed of the same individuals who conducted the comprehensive medical evaluation prior to flight, examined the pilot 30 hours after landing. In addition to the actual physical examination by physicians, the physical evaluation of the astronaut was based upon an electrocardiogram, an electroencephalogram, chest X-rays, and clinical laboratory studies. A summary of the preflight and postflight medical examinations is presented in table 3–IV. Aside from the postflight blood pressure findings and the abrasion on the right hand, all findings were normal.

## Special Studies

The special studies conducted for Mercury flights are nonroutine medical procedures designed to provide information about selected body functions and sensations in the spacecraft environment during flight. These studies for MA–8 comprised biochemical and plasma enzyme determinations and three special measurements.

### Special Measurements

For the MA–8 mission, the modified caloric test, radiation dosimetry, and retinal photography were the special measurements obtained. One of two modified caloric tests was accomplished 6 days before the flight and the other 2 hours after landing, both by the same physician. Retinal photography and the modified caloric tests revealed no significant changes from the preflight tests. The procedure for the modified caloric test is discussed in detail in reference 8. In addition to the radiation packs (see Scientific Experiments section of paper 1) carried in the spacecraft, three self-indicating dosimeters were placed on the inside of the hatch by the astronaut after launch. Two solid-state lithium fluoride dosimeters were also installed in the helmet liner at eye level, and three dosimeters of this type were placed on the inside of the underwear, two of which were on the chest and one on the thigh. The self-indicating and solid-state dosimeters revealed that the astronaut's exposure to radiation was insignificant.

### Biochemical Studies

A comparison of the MA–8 biochemical determinations reveals that the astronaut's 9-hour exposure to weightlessness resulted in no biochemical changes which had not been noted after exposure to previous manned orbital flights. Peripheral blood values (table 3–V), including electrolytes, revealed that blood calcium was maximal in the immediate postflight period, but returned to the preflight level within 14½ hours. Such changes, also displayed by the MA–6 and MA–7 pilots, are only suggestive because of their very low magnitude and may have resulted from a number of causes, including dehydration, normal physiologic variation, and laboratory variation. The urinary findings substantiate a minimal dehydration. Intake and output are not discussed since the important inflight urinary output is unknown. The postflight rise in urinary calcium never reached the preflight value, and no abnormality can be established.

### Plasma Enzyme Studies

The number and type of enzyme studies for this mission were modified in order to obtain the maximum amount of useful information from a minimum number of determinations. The results of these determinations are presented in table 3–XI. Many of the postflight values are near or above the normal range for Astronaut Schirra, as well as for astronauts of previous flights. The reason for this elevation is most probably the fact that these individuals are all of a lean body-mass type. Further analysis of the enzyme results, especially heat-stable lactic dehydrogenase, suggests that these postflight elevations are the result of muscular activity rather than the visceral pooling of blood.

## Conclusions

1. There was no evidence of disorientation or related untoward symptoms during the 9-hour period of weightlessness. The inflight orientation test demonstrated no impairment of performance during this weightless period.
2. An orthostatic rise in heart rate, fall in systolic blood pressure, and maintenance of the diastolic pressure was noted during the 24 hours immediately after landing. Such a hemodynamic phenomenon may have more serious implications for a longer mission. A prescribed inflight exercise program may be necessary to preclude symptoms in case of the need for an emergency egress soon after landing.
3. Lability of instantaneous heart rate was noted and was not associated with respiration or other known physical activity. The cause of this phenomenon is unknown.
4. There were no significant medical abnormalities, other than those previously mentioned, during or following this mission.
5. The radiation exposure was minimal and posed no hazard to flight.
6. There are no medical contraindications to embarking on a longer mission.

*Acknowledgments.*—The contributions of the following individuals were most helpful in the preparation of this paper: A. Duane Catterson, M.D., David P. Morris, M.D., Robie Hackworth, and Nelson Parsons, Aerospace Medical

*Table 3–XI.—Plasma Enzyme Summary*

| | Normal values | Preflight | Postlanding | | | |
|---|---|---|---|---|---|---|
| | | −15½ hr | +1½ hr | +5 hr | +24½ hr | +51 hr |
| Cholesterol, total, mgm/100 ml | 150 to 240 | 225 | 290 | 270 | 265 | 270 |
| Cholesterol esters, percent | 60 | 70 | 74 | 70 | 70 | 69 |
| Leucylamino peptidase | 100 to 310 | 550 | 460 | 530 | 485 | 500 |
| Phosphohexose isomerase | 10 to 20 | 28 | 22 | 13 | 23 | 21 |
| Lactic dehydrogenase | 150 to 250 | | | | | |
| Incubated, 20° to 25° C | | 250 | 225 | 200 | 275 | 250 |
| Heat stable, 60° C | | 60 | 75 | 65 | 75 | 75 |
| Heat stable, percent | 14 to 15 | 24 | 33 | 33 | 27 | 30 |
| Malic dehydrogenase | | 275 | 325 | 225 | 300 | 325 |

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# 4. PILOT PERFORMANCE

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### Summary

The results of the MA–8 orbital flight of Astronaut Walter M. Schirra, Jr., further verify that man can function effectively in a space environment, in this instance for a period of up to 9 hours. The pilot was able to position the spacecraft to a given attitude and to complete attitude maneuvers with a high degree of accuracy and a minimum amount of control-system fuel by using only visual references as seen through the spacecraft window. This flight provided additional evidence that man can perform primary control tasks and serve as an effective backup to the automatic control modes provided. During the MA–8 mission, the pilot also demonstrated that he can efficiently perform the role of an engineering test pilot while orbiting in a space environment if the pilot devotes his primary attention to the management of spacecraft systems and the operational aspects of the mission.


### Introduction

The pilot's primary responsibility during the MA–8 mission, as in the previous orbital missions, was to monitor and manage systems operations and, if necessary, to take corrective action in order to achieve the prescribed mission objectives. The pilot's secondary responsibility during this mission was to accomplish various in-flight activities that would further evaluate the spacecraft systems as well as provide a basis for evaluating man's performance in space. Experimental scientific activities were somewhat reduced for this mission in view of the greater emphasis placed on operational objectives. The purpose of this paper is to report on the pilot's effectiveness in achieving the primary mission objectives. The pilot's performance in conducting certain scientific experiments, secondary objectives for this mission, are not described in this paper since they are discussed in the Scientific Experiments section of paper 1.

### Flight Plan Description

A flight plan was designed for the MA–8 flight to guide the pilot in carrying out the mission objectives with particular emphasis upon systems' management and control-fuel conservation. Only a few scientific activities were scheduled late in the mission on a flexible basis so as not to interfere with operational mission requirements. Control systems were to be evaluated prior to extending the flight duration beyond three orbital passes.

The pilot's adherence to the flight plan was excellent, and all major activities were accomplished within the time periods scheduled. The spacecraft control systems were completely checked out during the first three orbital passes; and the drifting flight phase, as well as the automatic-control-system evaluation scheduled during the final three passes, was completed as planned. Observations of the ground flares at Woomera, Australia, and of the high intensity lights at Durban, South Africa, were attempted at the proper times; but, poor weather conditions prevented the pilot's observation of both light sources.

### Preflight Performance

In preparing for this flight, Astronaut Schirra participated in extensive training and spacecraft checkout activities. In general, his preflight activities were similar to those accomplished by the pilots of the previous orbital flights, except that more time was devoted to becoming familiar with the spacecraft systems through briefings and discussions and less time was spent in using the Mercury procedures trainer.

As a result of the experience gained from previous Mercury flights, the pilot was able to prepare for this flight in a more efficient manner than has been possible in the past. The flight plan was more flexible and was finalized at an earlier date, operational requirements were emphasized, and nonoperational objectives were

FIGURE 4–1.—Astronaut Schirra examining hand-held camera.

reduced. Consequently, the pilot had the necessary additional time to become more familiar with the spacecraft and launch-vehicle systems.

The major preflight pilot activities in the period from July 11, 1962, to the date of launch are given in table 4–I. During the preflight preparation period, the pilot was engaged in a diversity of activities often requiring considerable travel and resulting in a crowded schedule. As can be seen from this summary table, the pilot spent a large portion of his time in briefings and meetings concerning every aspect of the mission. For example, the pilot became familiar with the hand-held camera used during the flight (see fig. 4–1). In addition, he completed such required training activities as recovery training, survival-pack exercises, acceleration refamiliarization on the centrifuge, and review of the celestial sphere at the Morehead Planetarium, Chapel Hill, N.C. The pilot also logged 35 hours in the T–33-, F–102-, and F–106-type aircraft during his preflight preparation period. Flights to maintain proficiency in high performance fighter aircraft are considered an important phase of training because the pilot must maintain the ability to

*Table 4–I.—Pilot Preflight Preparation History*

| Date (1962) | Day | Activity |
|---|---|---|
| July 11 | Wed | Flight plan meeting, flight film meeting |
| July 12 | Thurs | Flight plan review |
| July 13 | Fri | Scheduling meeting |
| July 14 | Sat | Flying (T–33) |
| July 16 | Mon | Flight plan review |
| July 17 | Tues | Scientific panel meeting |
| July 18 | Wed | Mission rules review; flying (T–33) |
| July 20 | Fri | Camera and onboard equipment briefing |
| July 23 | Mon | A.m.: Flight activities discussion, scheduling meeting<br>P.m.: TV interview (Telstar) |
| July 24 | Tues | Blood pressure cuff discussion, systems briefing (ASCS) |
| July 25 | Wed | Systems briefings (ASCS and RCS) |
| July 26 | Thurs | Systems briefing (sequential) |
| July 27 | Fri | Flight plan presentation |
| July 28 | Sat | Flying (T–33) |
| Aug. 1 | Wed | A.m.: Systems briefings (communications and environmental control system)<br>P.m.: Ultraviolet camera briefing |
| Aug. 2 | Thurs | A.m.: Systems briefing<br>P.m.: Weather briefing |
| Aug. 3 | Fri | Geology briefing (terrestrial photography) |
| Aug. 4 | Sat | Flying (F–106) |
| Aug. 6 | Mon | Scheduling meeting, flying (T–33) |
| Aug. 8 | Wed | Flying (T–33) |

*Table 4–I.—Pilot Preflight Preparation History*—concluded

| Date (1962) | Day | Activity |
|---|---|---|
| Aug. 10 | Fri | Review of contractor documents |
| Aug. 11 | Sat | Systems tests |
| Aug. 12 | Sun | Systems tests concluded |
| Aug. 13 | Mon | Sequential system checks |
| Aug. 14 | Tues | Sequential system checks concluded |
| Aug. 15 | Wed | Survival equipment meeting, flying (F–106) |
| Aug. 16 | Thurs | Recovery training |
| Aug. 17 | Fri | Weight and balance |
| Aug. 20 | Mon | Mercury procedures trainer, flying (F–106) |
| Aug. 21 | Tues | Survival pack exercise |
| Aug. 22 | Wed | A.m.: Flight plan activities meeting<br>P.m.: Mercury procedures trainer |
| Aug. 23 | Thurs | Mercury procedures trainer |
| Aug. 24 | Fri | Johnsville centrifuge Atlas "g" refamiliarization |
| Aug. 25 | Sat | Morehead Planetarium celestial review |
| Aug. 27 | Mon | Meeting on checklists |
| Aug. 28 | Tues | Mercury procedures trainer, flying (F–106) |
| Aug. 29 | Wed | A.m.: Mercury procedures trainer<br>P.m.: Scheduling meeting |
| Aug. 30 | Fri | Flight plan meeting |
| Sept. 1 | Sat | Flying (T–33) |
| Sept. 4 | Tues | Flight controller briefing |
| Sept. 5 | Wed | Flying (T–33) |
| Sept. 6 | Thurs | Systems briefings (ASCS and RCS) |
| Sept. 7 | Fri | A.m.: Systems briefings (electrical and sequential)<br>P.m.: Launch vehicle meeting |
| Sept. 8 | Sat | Mercury procedures trainer |
| Sept. 10 | Mon | Mercury procedures trainer |
| Sept. 11 | Tues | A.m.: Simulated flight no. 1<br>P.m.: Brief the President of the United States; Mercury procedures trainer |
| Sept. 12 | Wed | A.m.: Readiness examination<br>P.m.: Mercury procedures trainer |
| Sept. 13 | Thurs | Flight plan activities review, checklists review, flying (F–102) |
| Sept. 14 | Fri | Simulated flight no. 2 and flight acceptance test, air-ground communications check |
| Sept. 15 | Sat | Mercury procedures trainer |
| Sept. 17 | Mon | Questionnaire review, air-ground communications check, flying (F–102) |
| Sept. 18 | Tues | Mercury Control Center–Bermuda simulation |
| Sept. 19 | Wed | Flight configuration sequence and aborts |
| Sept. 20 | Thurs | A.m.: Mission review<br>P.m.: Mercury procedures trainer |
| Sept. 21 | Fri | Launch simulation and RF compatibility, flying (F–102) |
| Sept. 22 | Sat | Network simulation |
| Sept. 24 | Mon | Training facilities meeting (Houston), flying (T–33) |
| Sept. 25 | Tues | Mercury procedures trainer |
| Sept. 27 | Thurs | A.m.: Flight plan discussion, mission review<br>P.m.: Mercury procedures trainer |
| Sept. 28 | Fri | Launch simulation and RF compatibility, flying (F–102) |
| Sept. 29 | Sat | Simulated flight no. 3 |
| Sept. 30 | Sun | Mission review |
| Oct. 1 | Mon | A.m.: Mercury procedures trainer<br>P.m.: Physical examination |
| Oct. 2 | Tues | Pilot briefing, study |
| Oct. 3 | Wed | Launch |

*Table 4–II.—Pilot Time in Spacecraft 16 During Hangar and Launch Complex Tests From August 11, 1962, to Flight Date*

| Date (1962) | Spacecraft tests | Duration, hr:min |
|---|---|---|
| Aug. 11 | Systems tests (Hangar S) | 02:15 |
| Aug. 12 | Systems tests concluded | 05:15 |
| Aug. 13 | Sequential system checks | 02:45 |
| Aug. 14 | Sequential system checks concluded | 02:17 |
| Sept. 11 | Simulated flight no. 1 | 03:25 |
| Sept. 14 | Simulated flight no. 2 and flight acceptance test | 02:20 |
| Sept. 19 | Flight configuration sequence and aborts | 03:20 |
| Sept. 28 | Launch simulation and radio frequency compatibility | 03:20 |
| Sept. 29 | Simulated flight no. 3 | 06:30 |
| Total | | 31:27 |

make rapid and accurate decisions under actual operational conditions.

Astronaut Schirra achieved a high level of skill on the procedures trainer in performing the turnaround and retrofire maneuvers. Use of the transparent gyro simulator and a very good understanding of the spacecraft control systems and their operation prepared him adequately for scheduled in-flight activities, such as control mode switching, flight maneuvering, drifting flight, and the gyro caging and uncaging procedures that cannot be properly simulated on the procedures trainer. Preparation in such areas as emergency procedures, mission anomalies, egress from the spacecraft, and recovery procedures was also satisfactorily accomplished.

Active participation in spacecraft checkout activities enabled the pilot to become familiar with the systems of the MA–8 spacecraft and the Atlas launch vehicle. This familiarity permitted him to manipulate and evaluate his flight equipment along with the various modifications to flight systems and switching procedures specific to the *Sigma 7* spacecraft. Table 4–II summarizes these activities from August 11 to October 3, 1962, during which period the pilot spent 31 hours and 27 minutes in the spacecraft itself and many additional hours before and after each checkout operation in preparation, observation, troubleshooting, and discussion. In addition, Astronaut Schirra, as the backup pilot for the MA–7 misson, spent 45 hours in the *Aurora 7* spacecraft during the MA–7 preflight period. This experience added significantly to his knowledge of the Mercury spacecraft and launch vehicle systems.

The pilot's training activities using the Cape Canaveral procedures trainer from August 20 to October 1, 1962, are summarized in table 4–III. This table does not include the 28 hours spent in this trainer during the MA–7 preflight period, or the 8 hours spent in the Langely procedures trainer during June 1962 in which manual control of possible reentry-rate oscillations was practiced and flight plan control tasks were evaluated. During the training period at Cape Canaveral, the pilot spent 29 hours and 15 minutes in the trainer accomplishing 37 simulated missions which included 40 turnaround maneuvers, 53 retrofire maneuvers, and 68 simulated failures. The pilot devoted nearly as much time to briefings and debriefings in conjunction with each training session as he spent in the trainer. The greatest emphasis during these simulations was on the more basic operational aspects of the mission because of their relative importance and because the procedures trainer is best equipped to accomplish these requirements. The pilot participated in several simulated launch aborts and network exercises during which the mission rules were rehearsed and discussed.

The pilot received three series of formal briefings which were oriented as much as possible towards the operational requirements of the mission. In addition, he spent well over 100 hours in reviewing informally the operation of spacecraft systems with specialists during the 2 months prior to launch in order to establish mission operational procedures.

*Table 4–III.—Pilot Training Summary in the Mercury Procedures Trainer No. 2 (Cape Canaveral)*

[68 simulated failures, 40 turnaround maneuvers, 53 retrofire attitude control maneuvers]

| Date (1962) | Type of training | Time, hr: min | No. of missions | Failure number and type | | | | | | Special training activities [1] |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | ECS | RCS | Sequential system | Electrical system | Communication system | Other | |
| Aug. 20 | New switch function familiarization | 01:30 | 1 | ---- | ---- | ---- | ---- | ---- | ---- | 1, 4, 5 |
| Aug. 23 | One-orbital-pass mission | 01:30 | 1 | ---- | ---- | ---- | ---- | ---- | ---- | 1, 4, 5, 6 |
| Aug. 28 | Flight plan familiarization, simulated systems failures. | 01:45 | 1 | ---- | ---- | 1 | 1 | ---- | ---- | 3, 4, 6 |
| Aug. 29 | Flight plan familiarization | 00:35 | 1 | ---- | ---- | ---- | 1 | ---- | ---- | 1, 4, 6 |
| Sept. 8 | Simulated systems failures | 03:00 | 4 | ---- | 1 | 3 | 3 | 1 | 1 | 1, 2, 3 |
| Sept. 10 | Simulated systems failures | 01:35 | 3 | ---- | 1 | 3 | 3 | ---- | ---- | 1, 2, 3, 6 |
| Sept. 11 | Simulated systems failures | 01:30 | 3 | 1 | ---- | 2 | 3 | ---- | 3 | 2, 3, 4 |
| Sept. 12 | Simulated systems failures | 01:15 | 4 | 3 | ---- | 2 | 1 | ---- | 1 | 2, 3, 4, 5 |
| Sept. 15 | Simulated systems failures | 02:25 | 3 | 2 | ---- | 5 | 1 | 1 | ---- | 2, 3, 6 |
| Sept. 18 | MCC–Bermuda simulation | 03:35 | 4 | 1 | 2 | 2 | 2 | 3 | 2 | 2, 3 |
| Sept. 19 | MCC–Bermuda simulation | 00:30 | 1 | 1 | ---- | ---- | ---- | ---- | 1 | 2 |
| Sept. 20 | Simulated attitude control system failure | 02:30 | 4 | 2 | 1 | 1 | ---- | ---- | 3 | 1, 2, 3, 4, 5 |
| Sept. 22 | Network simulation | 01:00 | 1 | ---- | ---- | ---- | ---- | ---- | ---- | 1, 4 |
| Sept. 25 | Flight plan work | 02:00 | 1 | ---- | ---- | ---- | ---- | ---- | ---- | 1, 4, 6 |
| Sept. 27 | Simulated attitude control system failure | 01:05 | 1 | ---- | ---- | ---- | ---- | ---- | ---- | 1, 5, 6 |
| Oct. 1 | Network simulation, simulated systems failures. | 03:30 | 4 | ---- | ---- | 3 | ---- | ---- | ---- | 1, 2, 4 |
| Total | | 29:15 | 37 | 10 | 5 | 22 | 15 | 5 | 11 | |

[1] Training activities key:
- 1—Normal launches and reentries
- 2—Launch aborts
- 3—Orbital and reentry emergencies
- 4—Turnaround maneuvers
- 5—Retrofire attitude control
- 6—Flight plan activities (equipment manipulation, control mode switching, yaw maneuvering, et cetera)

## Control Tasks

Several in-flight maneuvers and control tasks were programed for the MA–8 flight to obtain additional information on possible orientation problems in space and the ability of the pilot to perform various attitude control tasks using accuracy and fuel expenditure as the primary criteria of performance. These tasks are discussed in the following paragraphs.

### Turnaround Maneuver

The primary purpose in accomplishing a manual turnaround maneuver using the fly-by-wire control mode, low thrusters only, was to conserve control-system fuel. Therefore, it was planned that, if the flight was proceeding normally, the turnaround would be executed at a leisurely pace using a 4-degree-per-second rate about the yaw axis.

The pilot performed this maneuver identically as it has been practiced on the procedures trainer prior to the flight. Figure 4–2 shows the spacecraft attitudes as indicated by the gyros and a background envelope of five turnaround maneuvers accomplished on the procedures trainer for comparison. The pilot performed the maneuver smoothly and with precision. Only 0.3 pound, or less than 1 percent, of the automatic-control-system fuel supply was used. This quantity amounts to approximately 10 percent of the total control fuel typically required by the automatic control system for accomplishing this same maneuver.

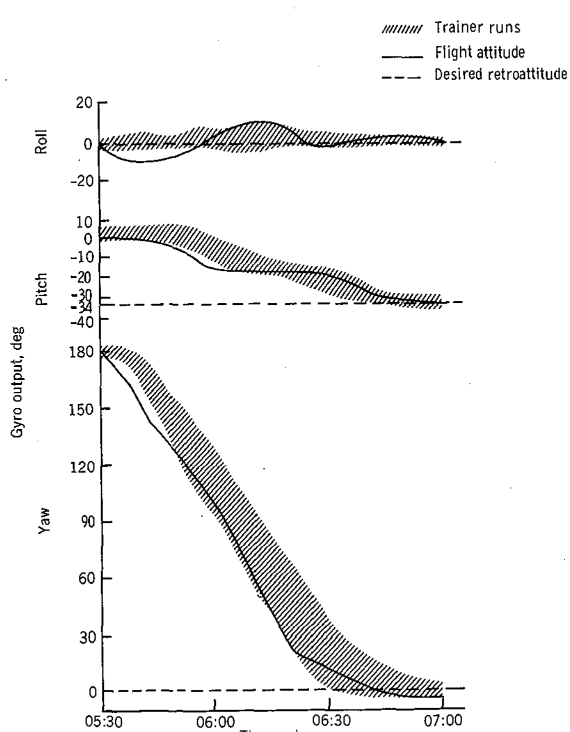



FIGURE 4–2.—Turnaround maneuver.

The pilot reported that the turnaround maneuver proceeded just as it had on the procedures trainer. In accordance with practice in the trainer, Astronaut Schirra used only the rate and attitude indicators for reference, and he resisted the temptation to look out the window when the horizon first came into view.

### Yaw Maneuvers

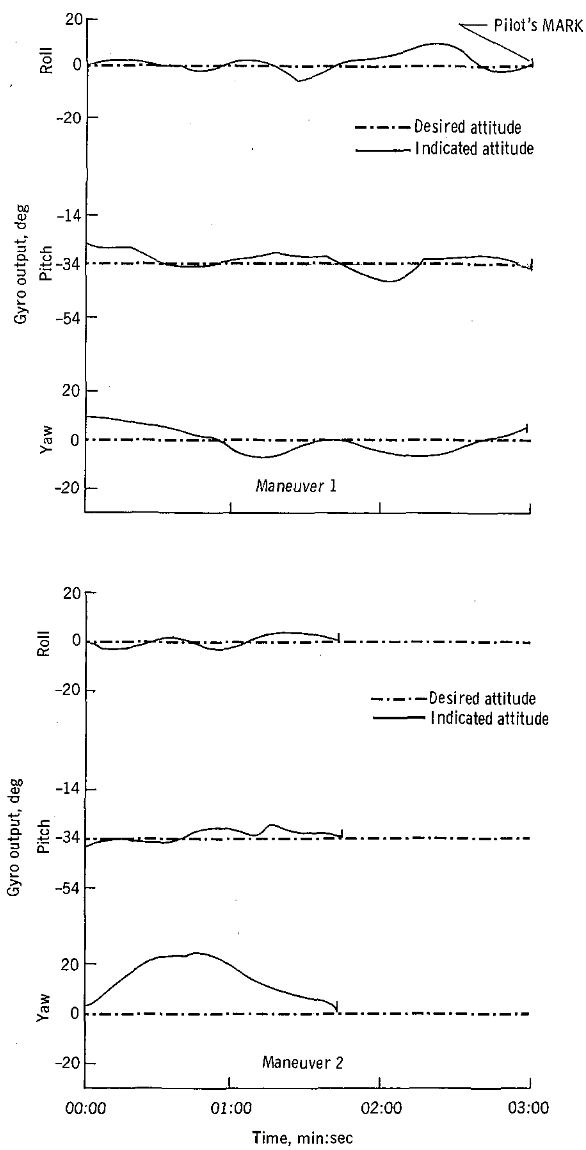
A series of yaw maneuvers were planned for this flight to obtain quantitative information on the use of the window and periscope as independent references for determining and acquiring the proper spacecraft attitude about the yaw axis. The yaw indicator was to be covered and the spacecraft displaced in yaw. However, this maneuver was planned so that the yaw attitude would be retained within gyro and repeater stop limits. These maneuvers were to be performed during both daytime and nighttime phases of the orbit in which the views through the window and the periscope were used independently as external references.

The pilot stated very early in the flight that he could accurately estimate yaw attitude during periods when either the automatic stabilization and control system (ASCS) mode was operating or when in a drifting flight mode.

The first yaw maneuver on the daylight side of the earth in which the view through the window was used as a reference was performed at a ground elapsed time (g.e.t.) of 1 hour and 41 minutes over Bermuda during the second orbital pass. This maneuver was followed at 01:50 g.e.t. by a similar exercise using the view through the periscope as a reference. In additi on yaw maneuvers on the night side of the earth in which the view through the window was again used as a reference were performed in sequence over Muchea, Australia, during the second orbital pass at 02:26 and 02:28 g.e.t. The results of these yaw maneuvers are presented in figure 4–3, which gives the variati on in spacecraft roll, pitch, and yaw attitudes. Table 4–IV lists the fuel usage, time required, control

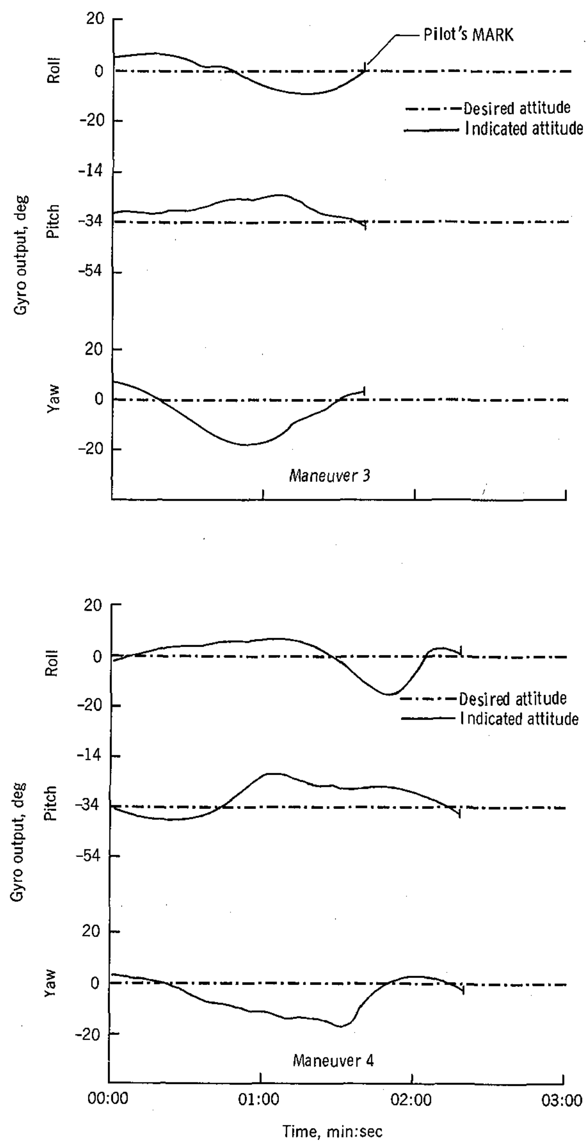
*Table* 4-IV.—*Yaw Maneuvers*

| Maneuver | Visual reference | Control mode | Automatic fuel usage, lb | Gyro switch position |
|---|---|---|---|---|
| 1 | Wndow | Fly-by-wire, low | 0.39 | Normal |
| 2 | Periscope | Fly-by-wire, low | .32 | Free |
| 3 | Window | Fly-by-wire, low | .23 | Free |
| 4 | Winow | Fly-by-wire, low | .30 | Free |




(a) Day

Figure 4-3.—Yaw maneuvers.




(b) Night

Figure 4-3.—Concluded.

mode, and visual reference used for these yaw maneuvers, which are discussed below in the order tabulated.

The first yaw maneuver on the day side of the earth consisted of three separate yaw displacement and realinement maneuvers accomplished in rapid sequence. The pilot did not, however, record an attitude "MARK" on the voice tape until the end of the final maneuver of the sequence. The pilot yawed the spacecraft approximately 8° to 10° from 0° in each case, holding pitch and roll attitudes reasonably close to retroattitude as intended. At the termination of this maneuver yaw misalinement was +4°, with roll and pitch attitudes at the nominal 0° and −34°, respectively. As a result of this maneuver, the pilot reported that yaw errors could be readily recognized and corrected by using the terrain features or any available type of cloud formation through the window. The pilot reported, and the results of this maneuver verify, that yaw realinement could be accomplished while holding the nominal retroattitude of −34° in pitch. This attitude in pitch makes the horizon available for maintaining proper attitudes in pitch and roll while the spacecraft is being oriented in yaw.

In the second yaw maneuver on the daylight side of the earth, the pilot yawed 23° to the right while holding pitch and roll within ±5° of the desired attitudes. At the termination of this maneuver, the spacecraft was in error by only +2° in yaw, with pitch and roll at −33° and 0°, respectively.

The pilot reported that yaw misalinements were readily apparent and that realinement to 0° could be effected rapidly by using only the periscope reference. However, as a result of the two daytime yaw maneuvers, he reported that the window provided an adequate yaw reference and that the periscope constituted a redundant external reference system.

In the third and fourth yaw maneuvers accomplished on the nightside of the orbit, the astronaut employed the window as a reference because he found the periscope to be ineffective at night. In performing each of these maneuvers, the pilot yawed approximately 20° left and then was able to realine in yaw very close to 0°. At the termination of the third maneuver, the yaw error was +3°; and at the end of the fourth maneuver, the yaw error was −1°. In the course of completing both of these maneuvers, pitch attitude was increased from the nominal −34° to approximately −22°; however, pitch attitude was returned to about −34° by the end of each maneuver. Excursions in roll were somewhat larger for these maneuvers than they had been during the daylight yaw maneuvers; however, these errors were also reduced to nearly zero at the completion of the maneuver. The pilot used the Moon and the planet Venus as visual references in performing both of these maneuvers.

Astronaut Shirra reported that yaw determination on the nightside was more difficult than during the daylight phase because of the small field of view available for the acquisition of star patterns. He reported that only through concentrated effort could he acquire attitude alinement about all axes by using the airglow layer as his reference in pitch and roll and a known celestial body for yaw reference.

The results of these four maneuvers indicate that for yaw misalinements of the order obtained during this flight, the spacecraft can be realined in yaw during the day or during moonlit night conditions by using the window view as the only visual reference. Quantitatively, these maneuvers were accomplished in a 2- to 3-minute time period with an average usage of between 0.2 and 0.3 pound of control fuel, and realinement of spacecraft attitudes to within ±5° of the nominal retroattitude was readily achieved. Yaw alinement on the daylight side in which the periscope was used required approximately the same amount of control fuel and time as was required when the window reference was used with little or no improvement in accuracy.

#### Drifting Flight

The spacecraft was permitted to drift completely free in attitude on two different occasions to conserve control fuel. During this time, power to the ASCS was switched off (powered down) to conserve electrical power. On three additional occasions, the pilot maintained the spacecraft attitudes within the limits of the horizon scanners with a minimum amount of control inputs. This flight mode is referred to as limited drifting flight. A total of 2 hours and 29 minutes was spent in both types of drifting flight during this mission, with the longest continuous period extending for 1 hour and 42 minutes. Most of the drifting period was devoted to flight in the attitude-free state. The total control fuel usage directly associated with the drifting flight phases was approximately 1 pound, and this was almost entirely consumed in reestablishing attitudes at the termination of each period of drifting flight. Drifting flight was not disturbing to the pilot, and the flight results verify that this operational technique provides an excellent means of conserving fuel and electrical power.

#### Gyro Realinement Maneuvers

The gyros were realined to an earth reference through the window by using fly-by-wire on two different occasions. At the completion of both maneuvers, the gyros and horizon scanners were alined quite closely, and torquing of the gyros to the horizon scanners quickly corrected any remaining disparities. The first gyro realinement required 1.71 pounds, but the second maneuver required only 0.66 pound of automatic control fuel.

The first maneuver was accomplished entirely during the night period of the orbit and required two separate gyro caging and uncaging operations to obtain the correct alinement. The procedure used was to determine attitude by observing available star patterns and to acquire and track the horizon by using 2-degree-per-second rates or less until the proper position was indicated in the window. The gyros were then caged and uncaged. At this point, roll and pitch were quite well alined; however, an error of approximately 35° in yaw attitude existed at this time. By using the constellation Cassiopeia as a visual reference, the pilot quickly recognized this yaw error and maneuvered to the proper heading.

The procedure used by the pilot in performing the second gyro realinement was: (1) to cage and uncage the gyros at $-34°$ in pitch and 0° in roll and yaw, and (2) to pitch up to an indicated attitude of $+34°$, while simultaneously holding roll and yaw attitudes at 0°, and again cage and uncage the gyros. The maneuver was performed during the daylight phase of the orbit, and again the earth horizon reference through the window was used. The errors in slaving the gyros to the horizon scanners were within $\pm 7°$ for all axes at the completion of this maneuver, and the scanners required less than a minute to correct remaining gyro errors.

#### Pitch Maneuvers

On four occasions during the flight, the pilot maneuvered from retroattitude to reentry attitude in pitch prior to selecting the automatic reentry-select control mode. Typical fuel usage for this pitch attitude change was 0.20 pound of the automatic fuel supply. During the final pitch maneuver to reentry attitude, the pilot simultaneously checked his fly-by-wire high thrusters, and this action resulted in a much higher fuel usage than the previous pitch maneuvers. The pilot performed these maneuvers with precision, and at the completion of each maneuver he engaged the automatic control system without actuating the high reaction control thrusters.

#### Retrofire

The pilot completed stowage of the items on the preretrofire checklist and was prepared well in advance of the retrosequence event. Just before the last sunrise prior to this event, the pilot used Jupiter, Fomalhaut, and the constellation Grus to verify that his gyro indicators were functioning properly. As planned, the automatic control system was used to control the spacecraft attitudes during retrofire, with the manual proportional control mode selected as a backup had it been required. During retrofire, he cross-checked his window reference and reported that his attitudes were constant within less than 1° about all axes. Just prior to retrosequence, he reported that the glare of the sun through the periscope was blinding and therefore placed the dark filter over the lens.

#### Reentry

As planned, the pilot used the rate stabilization and control system mode for controlling the reentry phase of the flight. Although this system was consuming large quantities of control system fuel at a rate which was expected (for example, 50 percent of the manual supply was expended from 0.05g to drogue parachute deployment), this fact almost led the pilot to select the auxiliary damping control mode of the ASCS.

## Systems Management and Operational Procedures

Throughout the mission, the pilot exhibited an excellent monitoring technique and operational procedure in managing the spacecraft systems. During the entire flight, the pilot reported clearly and accurately on the status of systems and maintained a verbal commentary on the in-flight activities, such as the yaw maneuvers, control mode usage, spacecraft elapsed time, and visual observations. The pilot exercised sound judgment and procedure in resolving the suit-circuit-temperature control problem. The procedure for switching off (powering down) and switching on (powering up) the ASCS inverter was performed exactly as planned. The pilot maintained an effective surveillance for possible discrepancies between true vehicle and gyro attitudes as well as the overall operation of the spacecraft's electrical systems. The proper fuse control switch positions were selected throughout the mission, and the drogue parachute and snorkle inlet valves were manually activated at the proper time.

### Control Mode Switching

The pilot's use of his control systems, as well as his control mode switching operations, was excellent. He was able to accomplish these switching operations with a very minimum amount of fuel usage.

Table 4–V lists the control modes and combinations of control mode configurations together with the total time and frequency that each control system was used during the flight. The pilot used a total of 14 single or dual control combinations and switched control modes 54 times during the mission. The automatic control system controlled the spacecraft during 60 percent of the total orbital flight time, whereas the pilot manually controlled the spacecraft 16 percent of this total. During the remaining 24 percent of the flight, the spacecraft was permitted to drift in an attitude-free mode.

The pilot selected the automatic control system on 23 different occasions. Only in one case did he inadvertently activate the automatic control system high thrusters, and this was

*Table 4–V.—Control Mode Utilization*

[Does not include gyro switch position]

| Control mode configuration [a] | Total time used in rank order, hr:min:sec | Maximum time used any one time, hr:min:sec | Frequency used |
|---|---|---|---|
| ASCS, retroattitude select | 04:57:34 | 01:15:29 | 16 |
| Free drift | 02:11:56 | 01:41:56 | 2 |
| FBW, low | 00:40:59 | 00:06:36 | 20 |
| ASCS, reentry select | 00:35:09 | 00:19:11 | 6 |
| Drift and FBW, low | 00:17:00 (approx.) | 00:09:22 | 3 |
| MP | 00:07:05 | 00:02:54 | 4 |
| RSCS | 00:06:28 | 00:06:28 | 1 |
| FBW, normal | 00:02:17 | 00:01:21 | 2 |
| ASCS, orientation, low | 00:01:06 | 00:00:10 | 17 |
| MP and ASCS | 00:00:53 | 00:00:53 | 2 |
| FBW, low, and RSCS | 00:00:31 | 00:00:31 | 1 |
| ASCS, orientation, high | [b] 00:00:36 | 00:00:23 | 3 |
| MP and FBW, low | 00:00:07 | 00:00:07 | 1 |
| ASCS, auxiliary damping | 00:00:04 | 00:00:04 | 1 |

[a] Key:
ASCS—Automatic stabilization and control system.
RSCS—Rate stabilization control system.
MP—Manual proportional.
FBW—Fly-by-wire.
Retroattitude and reentry select—Pitch attitude command by the ASCS as determined by the attitude select switch.
ASCS orientation—Orients spacecraft to either retroattitude or reentry attitude. High or low thruster actuation dependent upon deviation of rates and attitudes from those commanded by the orientation mode control logic.

[b] Includes the 23-second retrofire period.

because he engaged the automatic control system while the spacecraft was in proper retroattitude, but the attitude-select switch was in the reentry-attitude position. The only other time that automatic control system high thruster operation occurred, other than during the retrofire period, was just prior to 0.05g. This activation resulted when the ASCS in orbit mode failed to keep the spacecraft attitudes within the attitude limits.

The pilot selected double authority control on four occasions during the flight. Only the first case was inadvertent and occurred when the pilot changed from the manual proportional control mode to the fly-by-wire mode, low thrusters only. The pilot noticed the greater than normal response for the fly-by-wire, low, and immediately returned to a single control configuration.

The second case of double authority control occurred just subsequent to the single instance in which the pilot inadvertently actuated the automatic-control-system high thrusters. The pilot analyzed the situation as a stuck thruster in the automatic control system and therefore selected rate command in conjunction with fly-by-wire, low, to counteract the effect of the automatic-mode high thrusters.

In the third case, the manual proportional system was intentionally utilized to override the automatic system in order to correct for an error of approximately 10° in roll at the end of the horizon scanner test.

The final case of double authority control occurred during the ignition period for the retrorockets. The pilot selected manual proportional control, as planned, to back up the automatic control system in case it failed to control the spacecraft attitudes properly during this event.

#### Fuel Usage

The amount of fuel used during the maneuvering flight phase and control-mode switching exercises was much less than the amount which had been predicted from calculations based on the prescribed flight plan. A fuel usage history is presented in paper 1 in the section entitled "Spacecraft Control System." The fuel reserve at retrofire was approximately 80 percent of initial levels for both the manual and automatic fuel supplies, which represented a total fuel consumption of only 12 pounds for almost 9 hours of flight. The automatic control system controlled the spacecraft attitudes during 60 percent of the mission, and all of the scheduled maneuvers and control system operations were accomplished. The fuel economy exhibited on this flight can be attributed to the following:

1. The pilot performed the turnaround maneuver using only the fly-by-wire, low-thrust, control. Fuel usage for this maneuver was approximately 10 percent of that nominally required by the automatic control system to accomplish the same task.
2. The high thrusters of the automatic control system were activated only on two very brief occasions prior to retrofire, only one of which resulted from an oversight on the part of the pilot and which he quickly corrected.
3. The fly-by-wire mode, low thrusters only, was used for most of the manual maneuvers.
4. The pilot executed each nameuver smoothly and with minimal control inputs.
5. The pilot used a systematic procedure for fuel conservation, particularly during control system checks.

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# 5. PILOT'S FLIGHT REPORT

By WALTER M. SCHIRRA, JR., *Astronaut*


### Summary

A personal narrative is presented by Astronaut Schirra of his flight experiences during the MA–8 mission. In many instances, his observations are coincident with those of the astronauts for the two previous orbital missions. However, two notable differences should be mentioned. Astronaut Schirra observed a hazelike layer that was different in both character and size from that described by Astronauts Glenn and Carpenter, and, although both of these pilots spoke of the expended sustainer stage of the launch vehicle as silvery in appearance, Schirra described it as having appeared black. The pilot witnessed both types of space particles which had been observed by Glenn and Carpenter. After reviewing the details of the turnaround maneuver, the pilot discusses the possibility of rendezvous with the launch vehicle immediately after separation from it. Despite the fact that the MA–8 orbital phase was twice the length of the previous Mercury flight, Astronaut Schirra easily adapted to the space enviroment and suffered no ill effects from the long periods of attitude-free drifting flight. The astronaut's candid evaluation of the systems' performance throughout the flight is a reflection of the greater emphasis placed on the engineering aspects and was extremely valuable in making the postlaunch investigation of the flight results a comprehensive one.


### Introduction

One of the main objectives of this flight was an engineering evaluation of the spacecraft systems to determine their capabilities for an extended mission. In line with this objective, we wanted to demonstrate that the consumable supplies could be conserved sufficiently to permit longer duration flights in the future using the Mercury spacecraft. Of course, most of the consumables, such as water, electrical power, and contaminant filters, will have to be increased, but it is still important to determine the long-term consumption rates.

Since this was to be an engineering evaluation, the name chosen for my spacecraft was that of the mathematical symbol for summation, sigma, with the number 7 added to it for the seven-member Mercury astronaut team. Thus was derived the name and symbol that was painted on the spacecraft, *Sigma 7*.

The camaraderie of everyone concerned with the flight preparations and equipment meant a great deal to me. For example, it was certainly a thrill while entering the spacecraft on launch day to see a dummy "ignition key" on the control stick safety pin. This and other small gestures really helped to make me realize that there are many other people who were interested in what I was doing. We know this inherently, but these visible examples of it mean quite a bit. Here again, sigma symbolizes the summation of the great efforts exerted by each and every man in the vast Mercury team.

The following comments are my observations and impressions of the flight from the countdown to recovery. In the previous paper, the flight plan was described and my performance in completing the assigned tasks was discussed. In this report, I will amplify that discussion, as well as describe my own flight sensations. In the period since the flight, I have taken the opportunity to refine and analyze my flight experiences. In many instances, I will submit comparisons of my observations with those of astronauts who preceded me into space. It was their pioneering efforts which helped so much to make my flight a success.

## Countdown and Powered Flight

The countdown was conducted very successfully; there were absolutely no problems. The only delay was that resulting from a temporary loss of signal from the Canary Islands' radar system, but waiting for what proved to be a rapid repair was worthwhile since they had good radar acquisition during the first orbital pass. The tracking task is critical at this time, because it provides early definition of the spacecraft trajectory.

The boosted flight itself was disappointingly short. Considerable training was conducted to prepare me for emergencies which might occur during powered flight. We so often practiced system failures and aborts, either in the procedures trainer or by coordinating the trainer with the Mercury Control Center and Bermuda stations, that this practice made a very pronounced impression upon me.

This launch, in contrast, was a successful, normal flight where I encountered many new experiences. I still believe that the amount of practice we had for the period prior to insertion is important, in that here the pilot must be prepared for reaction to an emergency, rather than thinking one out.

There is no doubt about when lift-off occurred. If anything, I was somewhat surprised because it occurred earlier than I had anticipated. I heard the vernier engines start, felt them thrusting, and then heard the main engines start. During ascent, the communications with the Cape Capsule Communicator were perfect except for the few seconds when the noise of maximum dynamic pressure triggered the voice-operated relay and prevented the ground transmissions from reaching me. I never felt rushed, and all the events during launch were in order.

I had more than the anticipated time available to me to make my system checks. My scan pattern of the instrumentation panel was developed to where it was instinctive. I thought from my training that I might have missed on making a good electrical check prior to 3 minutes but subsequent to tower jettison; however, I found that I had completed that in time. There was absolutely no question as to when booster engine cutoff (BECO) occurred. The change in acceleration was quite obvious; whereas in the trainer, I could only wait for the accelerometer indication to decrease. There is no doubt, whatsoever, when these forces decrease in actual flight. Since beginning this mission, I had become familiar with checkoff points for various emergencies; for example, a no-BECO abort, a no-staging abort, and an abort at 3 minutes and 50 seconds after lift-off. It was a very pleasant feeling to check each of these off and put them behind me.

I knew that the launch vehicle staged without having to wait for confirmation from the Cape Cap Com, which, by the way, did come in rapid order. You can see the flashback of smoke from the booster engines as they part from the sustainer stage, and you can see the escape rocket when it is jettisoned. Unfortunately, the escape rocket blast left a light film on the window.

It did seem that the buildup of acceleration during the sustainer period was rather slow. As I look back, the forces I experienced while being accelerated in boosted flight seemed to be much less than the later forces of reentry. This comparison, I am sure, is best explained by the fact that you have a breathing point at BECO, in between the accelerations, while at reentry there is a long continuous buildup of accelerations which are equally as exciting as those during boosted flight.

## Orbital Flight

At sustainer engine cutoff (SECO), the sequence panel light did not seem to help very much. All the lights were somewhat dim, and I was made aware of these events better by the feel and sound than by the sequence light itself drawing my eye to it. After SECO, I immediately selected the auxiliary damping mode knowing from my previous training that there was no rush, selected fly-by-wire, low, on the thrust select switch, and commenced turnaround. I resisted every impulse to look out of the window at this point, as I wanted to make this a fuel-minimum turnaround by strictly monitoring the gyro instruments. I was pleased to note that I got exactly the turnaround I wanted in the fly-by-wire low control mode, including approximately 4 degrees per second left yaw. I had no trouble with any of the low thrusters at this time or at subsequent tines during the flight. I attained retroattitude at about 6 minutes and 50 seconds after lift-off and then selected ASCS, dropping into this automatic-pilot mode without any high thruster action.

After turnaround, I observed the sustainer stage right where it had been predicted to be, and I was very intrigued. I was somewhat surprised to see the sustainer engine pointing toward me. By this, I mean that it was basically in an attitude where it must have turned lengthwise 180°. It was moving very, very slowly in relation to its insertion attitude, although it had managed to make a 180° turnaround during the time I had made mine. I was also impressed with the fact that it was almost black in appearance, rather than the shiny silvery vehicle that Astronauts Glenn and Carpenter had seen at this time and that I had observed on the launching pad. The white belly band of condensed moisture, the frost itself, was apparent to me. The sustainer followed the path that was predicted, and this knowledge helped to satisfy me that the attitude gyros and horizon scanners were operating properly. I did not see any crystalline material exhausting from the sustainer engine which Scott Carpenter had described. The sustainer, in retrospect, appeared slightly to the right of the predicted position which indicated a slight error to the left in my indicated attitude about the yaw axis.

It was a very real satisfaction to receive the statement from the Cape Cap Com that I had at least a seven-orbit capability. As I proceeded on to the Canary Islands, the flight was textbook already. I never did feel rushed; in fact I could send a blood pressure, for example, and have little else to do. I got a good 10-minute check when the tower jettison and cap sep lights indicating spacecraft separation went out. I had loss of voice transmission with the Cape Cap Com just prior to 10 minutes. Although I had everything under control, I did store away all events and switch positions to transmit to the Canary Islands Station, since their relaying of these data would, in turn, update the flight director and the flight controllers back at the Cape.

At about 10 minutes 30 seconds, I went back to fly-by-wire, low, and tracked the sustainer as it traversed down through the window, and it was a thrill to realize the delicate touch that it is possible to have with fly-by-wire, low. This touch is an art that a pilot hopes to acquire in air-to-air gunnery for getting hits. In this case the control system was so effective that it just amounted to a light touch and maybe a few pulses in either axis to get the response I wanted. I could point the spacecraft at anything I wanted to. I could see the sustainer and track it, but I do not believe the relative motion problem would be so easy to solve that I would be able to steam along and join up with it. Although the relative velocity was on the order of 20 to 30 feet per second, it was enough to cause a problem, particularly at a time when one is becoming acclimated to a new environment. These problems would be difficult to solve by one's own inherent trajectory analysis, since there were no systems aboard to aid the pilot in solving the problem. I think that when we build up to the rendezvous technique, one will need more time than that just at the point of insertion to effect this rendezvous, even with proper training. The use of time while orbiting in space is only earth relative, therefore if a rendezvous is not hurried, the task should be relatively simple.

At the Canaries, the flight itself had settled into a very normal pattern. I was content with the autopilot function, although I was convinced by this time that I had a small discrepancy between indicated and actual yaw attitude. During the sustainer tracking exercise, I had disabled the yaw reference system, and I knew that I had to wait for it to precess out the errors before I misjudged it. Having pitched up with manual proportional control, I was content that the system was exactly as I felt it would be. The greatest effect I did notice in manual proportional control was the tail-off in thrust, rather than the response to control input. As a result, you have a tendency to overshoot, and you cannot park the spacecraft in the attitude you want without having to counteract and then recounteract a tail-off. As a result of this effect, almost every time I went from manual proportional back to automatic mode, I switched to fly-by-wire, low, to reduce these small rates to a level at which I could effect this transition without using high thrusters.

I did not have much chance to assess Africa as a viewing sight; I was much more engrossed in what was happening within the spacecraft. I did, of course, notice the color of Africa's desert terrain; it was difficult not to notice it. The country itself was exactly as I had anticipated from the orbital charts. At this time, I was well aware of the fact that we were working up to a slight suit-system cooling problem. I decided then to devote my primary attention to solving this situation before it became necessary to end the flight prematurely. I was well aware of the fact that people on the ground were probably quite concerned and were thinking in terms of previous missions when cooling problems had persisted. Therefore, I decided I had better solve this one.

I did not want to increase the valve setting for the suit circuit too rapidly. I had said before the flight that I wanted to increase the flow settings about half a mark every 10 minutes, and this technique had been agreed upon by the system specialists. I had to go from a setting of 4 to 8, which represents about eight half marks. This procedure would therefore take about 80 minutes. At a setting of about 7, I had arrested the increase in the suit and dome temperatures, and I needed about another 10 or 15 minutes to get the cooling I wanted. I did not want to increase the setting too rapidly and freeze the system. I had everything monitored closely, and while I saw the temperature was still going up as I increased flow, the rate of change of the temperature was decreasing.

Even though it seemed to me that the Mercury Control Center did not have as much information as I did on this temperature problem, their request that I decrease the suit setting back to 3 was valid. I later decided that they might have made an analysis that I had not and subsequently backed down to the number 3 position as requested. I gave the system about 10 minutes to respond and saw that both the dome temperature and the suit inlet temperature were increasing again, so I immediately went from there up to about 7.5, which again arrested the temperature increases.

Once the suit circuit temperature was under control, no other problems demanded such careful attention. Continually, I metered the attitude control fuel and attempted to conserve its use. Electrical power, which is stored in six batteries, is another consumable that I wanted to conserve. There were scheduled periods during the flight where I powered down electrical systems. In addition, I conserved electrical power by recording my observations with a voice operated relay "record-only" mode, rather than transmitting out of range of the Mercury tracking stations. Although we don't have a system for measuring the actual power remaining, battery voltage readings are a good indication, and I was very impressed that the voltage readings did not drop during the flight.

I do not believe I need to discuss the weather, the sun, or the stars. It seems more appropriate to discuss the events within in the spacecraft. Each network station got as much information as I had available to give them. Once we had solved the suit circuit problem and I had begun to feel cool, I knew we were in a "go" status and I had achieved my goal of using minimum fuel up to this point. I had stated long ago that I wanted to do some control maneuvers other than in fully automatic mode. I also had stated that I wanted to use the automatic mode when I did not need to employ manual modes or when I was too busy to fly the spacecraft, since this is why we have an autopilot. Admittedly, we have taken a system that was designed to be completely automatic and then tried to build some versatility into it and give the pilot the capability of controlling the vehicle as he desires. I had become satisfied with my capability of controlling the spacecraft before I got to the Canaries, a fact which I reported to the ground. From that time on, I merely wanted to make observations that seemed to have merit and to use the control system only during those periods when I had to reestablish the attitude within the limits required to drop back into the automatic mode.

I was discouraged by the tremendous quantity of cloud coverage around the earth and realized that it may always be a problem for certain space flight requirements. Africa, on the first and second passes, was ceiling and visibility unlimited (CAVU). The southwestern United States was also CAVU after I crossed over the ridge along the Baja California peninsula. I had a very good view, and I could easily determine yaw attitude by reference to the ground.

When I reestablished orbital attitude as I came over Muchea on the third pass, I was very pleased when I talked to the Muchea Cap Com, and he and I agreed on yaw attitude exactly except for a possible 4° error in left yaw, which was also indicated by my instruments. The telemetered scanner readings were coincident with the spacecraft attitudes, and I had just acquired these attitudes shortly prior to Muchea by using the Moon and the planet Venus adjacent to it for visual references. They actually showed up over the Indian Ocean Ship and were very easy to work with. They both lined up to give me a roll, pitch, and yaw reference.

A smog-appearing layer was evident during the fourth pass while I was in drifting flight on the night side, almost at 32° South latitude. I would say that this layer represented about a quarter of the field of view out of the window, and this surprised me. I thought I was looking at clouds all the time until I saw stars down at the bottom or underneath the glowing layer.

Seeing the stars below the glowing layer was probably the biggest surprise I had during the flight. I expect that future flights may help to clarify the nature of this band of light, which appeared to be thicker than that reported by Scott Carpenter.

It was a real treat to pass over each station and realize that they were as excited as I was and as envious as anyone could ever be. I saw the particles that John Glenn reported, and I also saw what Scott Carpenter reported as having seen. I believe that both phenomena are varied in appearance because of lighting conditions at sunrise and during bright daylight.

### Retrosequence

I checked the high thrusters in fly-by-wire prior to retrosequence, and on the first demand for each high thruster in all three axes, they worked and reacted beautifully. It was a tremendous feeling to know that I had no problem with the high thrusters becoming cool. At the nominal retrosequence, the Pacific Ocean Ship Cap Com gave a perfect count. Sequence and attitude lights actuated on time. I was sitting there ready to punch the retrosequence button. I did have the safety cover off the button and put it back on again. At the time of retrofire, the delay by a fraction of a second in firing the first rocket seemed agonizingly long. This time is probably the most critical of the flight, at least subsequent to insertion; and you know that these rockets have to work. Again, I was poised to punch off the retrofire button to back up the automatic system. I had its safety cover off, and I guess I put it back on again sometime later. The rocket iginition was crisp, clean, and each one actuated with a definite sound. There was no doubt as to when each rocket was firing. The spacecraft did not seem to vary as much as half a degree in attitude during the period of retrofire. I was also cross-checking out the window and had plenty of visual cues in case things did go wrong with the automatic mode. I could see stars that did not even quiver. Because of these cross-checks, I was aware that the ASCS was working well throughout this period and did not require any manual control imputs.

Subsequent to the retrofire maneuver, I controlled the spacecraft with fly-by-wire. I had the retrojettison switch armed in time, and the retropackage subsequently jettisoned. Control seemed somewhat loose. I guess I was probably excited about the fact that the retrorockets did ignite and did not have the cool head that I should have had. Therefore, I allowed the attitudes to drift off by perhaps 10° or 15° in roll and probably the same amount yaw and pitch. The flying was not really of poor quality, but it was not up to my usual standards. I then brought *Sigma 7* up to reentry attitude on fly-by-wire and intentionally actuated some of the high thrusters to see what it felt like. They reacted very well. At this time, I did not want to stay in the rate command mode and use a large quantity of fuel needlessly. I have always believed, with regard to full consumption, that the rate stabilization control system (RSCS) was the most expensive mode of the spacecraft. I came into retrosequence with 80 percent of fuel in each tank, which was higher than my mark, and I was quite pleased that I had that much. After retrofire, the automatic fuel was somewhere around 52 or 53 percent. I easily got into reentry attitude and felt very confortable with it. The periscope retracted on time. I noticed that my control of the spacecraft was still loose, so I tightened it up and then went into ACSC orbit mode. I wanted to see if the logic had picked up for reentry, and it dropped right in and held beautifully. Then, I set up rate command to give it a small check. It responded very well, and I was satisfied that that the system was working.

### Reentry

The beginning of the actual entry into the sensible atmosphere, with the attendant cues, was a very thrilling experience. Because my vision was somewhat obscured by perspiration on the inside surface of the visor, the cue for occurrence of the important event, 0.05g, was my visual sensing of the roll rate that was automatically induced by the control system rather than by the 0.05g event light on the panel. The spacecraft with a roll rate is something you just cannot effectively visualize in your mind. It is a very nice series of slow rolls, and you really feel as if you are back in the old fighter seat, just playing games. Looking out at the sky and at the surface of the earth which was starting to brighten up, I observed that the roll pattern was very slow and deliberate. You could integrate your attitude out of this very easily, and I knew that the spacecraft was as stable as an airplane.

The accelerations during reentry were not severe in the sense of bothering me, but it seemed to take much longer than I had anticipated. This was predictable, but it is just one of those things that you cannot seem to approximate in real time, even on the centrifuge which I had trained in just before the flight. It is difficult to store all these cues and inputs into your mind and just pull them out quickly. Physiologically, I never felt any strain as far as the reentry went. Each event came into place as closely as I could have wished.

As the acceleration buildup began, I could see external cues which were of great interest. I missed the hissing that John Glenn and Scott Carpenter described, possibly because I was concentrating so much on how the RSCS system was performing. I was prepared at any time to throw it into the auxiliary damping mode. As expected, an enormous amount of fuel was consumed during reentry before the drogue parachute was deployed. After drogue parachute deployment, of course, the fuel was jettisoned normally. But before the drogue parachute was deployed, that system must have been down to approximately the 20 percent level. This level corresponds to a total fuel consumption from the manual tank during reentry of some 60 percent, or approximately 14 pounds.

There were two occasions when I nearly switched from RSCS to the auxiliary damping mode. One was while I was monitoring the fuel gage; it looked just like a flowmeter. The indicator for the manual tank was visibly dropping. Yet, I continued with RSCS because I wanted to give it every chance to complete the reentry control task in order to evaluate it sufficiently. The second time that I thought about going to the auxiliary damping mode was when the yaw rate left the nominal 2.5 to 3 degrees per second and went off-scale (6°/sec) to the left. Soon after this occurrence, it held to about 5 degrees per second and then did the typical needle fanning that we have seen in the reentry training at Langley. Since it had started to hold again, I did not switch to auxiliary damping because I still wanted to allow the RSCS a full demonstration. However, I was perfectly content that the ASCS was working properly and it was good to know I had this powerful system ready to be switched on if needed.

I did see the green glow from the cylindrical section. It was a very pretty color, probably best described as a shade similar to limeade (a little green and chartreuse mixed together). This shade included a slightly stronger yellow cast than I had anticipated from earlier descriptions. One opinion which was ventured that might explain the green-yellow color is the copper treatment on the beryllium shingles. In fact, burning copper in a Bunsen burner flame is a good approximation to the effect that I saw. I did not see any distinctive color differences resulting from the different ablation panels that had been bonded to the beryllium shingles. There were no variances in color, such as a chromatic or a rainbow effect.

The altimeter came off the peg very nicely. I manually deployed the drogue parachute at 40,000 feet. There was a definite, strong thrumming accompanied by the drogue deployment, somewhat like being on a bumpy road. Although it is of no consequence, I was probably about 10 or 15 seconds slow in turning the hydrogen peroxide jettison fuse switch on, and this I can only blame on the intrigue and interest in looking at the drogue parachute up there straining and pulsating. The window definitely was further occluded during reentry.

I armed the recovery arm switch at about 15,000 feet. The main parachute opened at about 10,500 feet, and it was just as pretty as astronauts of previous flights had described it. It sort of puts the cap on the whole thing. I prepared for landing but did not hook up the survival raft to the suit.

### Landing and Recovery

On landing, *Sigma 7* seemed to sink way down in the water. It also seemed as if I were horizontal for a while. I allowed the main parachute to be jettisoned by punching in the main-parachute disconnect fuse. Then, I actuated the recovery aids switch to the manual position. The spacecraft seemed to take a long time to right itself, but again time is merely relative, and in actuality, the spacecraft righted itself in less than 1 minute. When *Sigma 7* had finally started to right itself, it was a very, very pleasant feeling, and at this point I knew I could stay in there forever, if necessary. The suit temperature was 75° F or 76° F, and the highest point reached prior to egress was 78° F.

I had very good communications with the Cap Com at Hawaii. The recovery carrier, which was probably the nearest thing other than the recovery helicopter, was really "down in the mud" as far as communications are concerned. Communications from the carrier were very weak, but legible, as evidenced by the fact that my request for permission to come aboard was immediately granted.

*Sigma 7* deserves some nonengineering closing remarks. Aviators are known to acquire an affection for their aircraft when it performs well, and now, in the space age, an astronaut should convey his personal thoughts about his spacecraft. I definitely fell in love with *Sigma 7*, and it is the first vehicle in my history of flight that finally replaced the F8F, a Navy propeller-type fighter, as the one on the top of the list. This spacecraft, the crew that prepared her, and the flight itself, truly combine to make this MA–8 experience the high point in my life.

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# APPENDIX

## AIR-GROUND COMMUNICATIONS OF THE MA–8 FLIGHT

The following is a transcript of the MA–8 flight communications taken from the spacecraft onboard tape recording. This is, therefore, a transcription of the communications received and transmitted, as well as some inflight comments made by the pilot, Walter M. Schirra, Jr., while in a record-only mode (VOX record). In some instances, ground-to-air communications were not decipherable from the onboard tape. Where possible, these communications were extracted from the Goddard-Mercury Control Center Conference loop tape recording, and are included in the text in brackets followed by the superscript G.

The first column shows the "capsule elapsed time" (c.e.t.) from lift-off, in hours, minutes, and seconds at which time the communication was initiated. (The c.e.t. was obtained from the recording of the spacecraft clock commutated time segments which were on the onboard tape. This time was decommutated to analog form and recorded on a special tape, which was processed through a computer.) Accuracy of this computed c.e.t. is $\pm\frac{1}{2}$ second.

At various times throughout the flight, the pilot or range station communicators indicated the precise time of an event by the word "MARK." The exact time at which the word "MARK" was transmitted was determined from the computer and is indicated by the time enclosed in brackets followed by the superscript T.

Communicators are identified as follows:

CC—Spacecraft Communicator at the range station
CF—Flight Director at Cape Canaveral
CT—Communications Technician at the range station
P—Pilot
R—Recovery helicopter from the U.S.S. *Kearsarge*
S—Surgeon or medical monitor at the range station
Stony—Blockhouse Communicator

All temperatures are given in °F; all cabin and suit pressures are in pounds per square inch, absolute (psia); fuel and coolant quantities are expressed in remaining percent of total nominal capacities; oxygen is expressed in hundreds of pounds per square inch (psi, hundreds). Retrosequence times are expressed in "ground elapsed time" g.e.t. (hours, minutes, and seconds).

Within the text, a series of dots is used to designate portions of the communication which could not be deciphered. One dash indicates a pause during a communication. The station in prime contact with the astronaut is designated at the initiation of communications.

CAPE CANAVERAL (FIRST PASS)

| | | |
|---|---|---|
| | Stony | 5, 4, 3. |
| 00 00 02 | P | I have the lift-off. Clock has started. And she feels real nice. |
| 00 00 08 | CC | Wally, you got a pin for this flight? |
| 00 00 10 | P | Yeah, I got the pins on my office wall. Altimeter's off the peg. |
| 00 00 15 | CC | Standby for 20 seconds. |
| 00 00 16 | P | Okay. |
| 00 00 18 | CC | 2, 1, MARK. [00 00 20]$^{T}$. |
| 00 00 21 | P | Roger. Backup started and running good. I'll give you a hack at my 30 [seconds]. Ah, she's riding beautiful, Deke. |
| 00 00 29 | CC | Looks real fine from here. |
| 00 00 30 | P | MARK 30. Okay. Fuel is okay. Oxygen is okay. All systems appear go, and she's getting noisy. |

| | | |
|---|---|---|
| 00 00 42 | P | Not at all too noisy. Easy to talk through. |
| 00 00 52 | P | Main cabin pressure is remaining on schedule. Fuel is okay. Oxygen is okay. Cabin pressure, 10 psi, and she's really moving. |
| 00 01 16 | P | Cape Cap Com, Sigma Seven. Do you read? Over. |
| 00 01 28 | P | Cape Cap Com, this is Sigma Seven. How do you read? Over. |
| 00 01 37 | P | Cape Cap Com, Sigma Seven. I read you. Over. |
| 00 01 45 | P | Cape Cap Com, Sigma Seven. I read. I am broadcasting in the blind; g is building. All systems are go here. |
| 00 01 54 | CC | Roger. How do you read now, Wally? |
| 00 01 55 | P | I read you beautiful. |
| 00 01 57 | CC | You had your transmitter keyed, that's why we couldn't read. |
| 00 02 00 | P | I'll be darn. I'm push-to-talk now. |
| 00 02 05 | CC | Stand by for staging. |
| 00 02 07 | P | I have a BECO. I could see the flash. |
| 00 02 16 | CC | Staging. |
| 00 02 17 | P | Roger. Staging. Standing by for tower. Fuel looks good. Oxygen looks good. |
| 00 02 25 | CC | Roger. Start a new flight. |
| 00 02 27 | P | Okay. I'm on push-to-talk, and the sun is coming in the window now. Okay. There goes the tower. |
| 00 02 35 | CC | Roger. |
| 00 02 37 | P | Auto retrojett off. This tower really is a sayonara. |
| 00 02 41 | CC | That pitch should be about −10 [degrees]. |
| 00 02 43 | P | Roger. I have about −5 [degrees]. Cabin pressure is holding very well at, right at 6 psia. |
| 00 02 51 | CC | Roger. |
| 00 02 52 | P | And I'll give an electrical check now. |
| 00 02 54 | CC | Roger. |
| 00 03 05 | P | Okay, a-c and d-c are all in the green. It looks real good. |
| 00 03 10 | CC | Roger. |
| 00 03 14 | P | I'll go back on VOX again. How do you read me on VOX now? |
| 00 03 21 | P | Cape Cap Com, Sigma Seven. |
| 00 03 22 | CC | Go ahead, Seven. |
| 00 03 24 | P | Okay. I'm back on push-to-talk. |
| 00 03 29 | CC | Roger. You have a go from Control Center. |
| 00 03 31 | P | Roger. You have a go from me. It's real fat. |
| 00 03 33 | CC | Roger. Have a go from here. |
| 00 03 36 | P | Roger. It looks real good. |
| 00 03 39 | CC | Are you a turtle today? |
| 00 03 41 | P | Going to VOX record only. You bet [Correct answer recorded]. |
| 00 03 46 | CC | Just trying to catch you on that one. |
| 00 03 48 | P | Nope—okay. I've finished VOX record. |
| 00 03 51 | P | Coming up on 4 minutes. I'll give you a hack. |
| 00 03 54 | CC | Good head. |
| 00 04 00 | P | MARK. [00 04 00]T. |
| 00 04 01 | CC | Roger. Right on the nose . . . 3 pitch. |
| 00 04 03 | P | Okay, and I've got good fuel, about 101–95 [percent]. Oxygen is fat 65–52 [psi in hundreds], correction 72. |
| 00 04 14 | CC | Roger. |
| 00 04 22 | P | She's starting to build up now. |
| 00 04 25 | CC | Roger. |
| 00 04 29 | P | Sunlight's in my upper right hand corner of the window, just peeking in at me. |
| 00 04 34 | CC | Roger. |
| 00 04 49 | P | How's the $V/V_r$? |
| 00 04 51 | CC | I get a 0.8 $V/V_r$. |
| 00 04 53 | P | Good show. |
| 00 04 59 | CC | Standby for SECO. |
| 00 05 18 | CC | SECO. |
| 00 05 20 | P | I have SECO. Cap sep, and in aux damp, and it's very pleasant. Going to fly-by-wire, low. Going to fly-by-wire. |
| 00 05 29 | CC | Roger. Fly-by-wire. |
| 00 05 32 | P | Yaw is answering very nicely. Roll answers nicely. She's turning around very nicely. |

| | | |
|---|---|---|
| 00 05 44 | CC | You have a go, 7 orbit capability. |
| 00 05 46 | P | Say again, I like that kind. |
| 00 05 54 | P | I see little ice crystals, I'm sure that's what it is, around me now. |
| 00 06 01 | CC | You're a little garbled. |
| 00 06 02 | P | Okay. Got a good view of the earth now. |
| 00 06 07 | P | Coming around to retroattitude. Coming into retroattitude; and a good shot of the sustainer here. It's right in the window where it belongs. I am pitched up a little bit. |
| 00 06 26 | CC | Roger. |
| 00 06 40 | P | Okay. Just about into retroattitude. |
| 00 06 46 | CC | Roger. We have full communications. Tell me, can you confirm retrojett off? |
| 00 06 54 | P | That's affirmative. Retrojett is off. |
| 00 06 57 | CC | That's fine. |
| 00 06 58 | P | Okay. I'm getting set up for yaw. I can see yaw at [−34] already. |
| 00 07 10 | CC | You say you still have some yaw? |
| 00 07 13 | P | Roger. I just went into ASCS at about 7 minutes and 10 seconds. The sustainer is sitting very steady above me. I should say above the horizon. And I'm in chimp mode right now and she is flying beautifully. |
| 00 07 34 | CC | I'll give you [contingency recovery area] 1–B retro 16 22. |
| 00 07 43 | P | Roger. Understand 16 22. Is that correct? |
| 00 07 47 | CC | Roger. 16 22. |
| 00 07 51 | P | Okay. I've got my chart case out. I'll put that in. I'll send the blood pressure now for the medics. |
| 00 07 59 | CC | Roger. |
| 00 08 02 | P | Boy! That sustainer looks real cute. I'll pick her up in a moment and track her. |
| 00 08 09 | CC | For your information, you are slightly garbled—slightly garbled. |
| 00 08 12 | P | Okay. I'll use VOX-push-to-talk as much as possible. |
| 00 08 16 | CC | Roger. |
| 00 08 21 | P | Okay, I'm stopping that blood pressure run. Boy! This ASCS made tracking very nice. The sustainer is very stable. It is not oscillating at all. I see no vapors; it looks very clean. |
| 00 08 48 | CC | 28 25. |
| 00 08 51 | P | Say again, Deke. |
| 00 08 56 | P | Cape Cap Com, Sigma Seven. Say again. |
| 00 09 03 | CC | Seven, Cap Com. You are fading—you are fading. |
| 00 09 08 | P | Roger. |
| 00 09 15 | P | Cape Cap Com. I read you loud and clear. |
| 00 09 29 | CC | Sigma Seven, Sigma Seven, Cape Cap Com. How do you read? |
| 00 09 34 | P | Cape Cap Com, this is Sigma Seven. I read you loud and clear. How me? |
| 00 10 15 | P | Cape Cap Com, Sigma Seven. How do you read? |
| 00 10 31 | P | This is Sigma Seven. Squib off. Three retro fuse switches on. Fire-arm on. Going to fly-by-wire, low. |
| 00 11 30 | P | This is Sigma Seven. Tracking sustainer very easily in fly-by-wire low. |
| 00 11 56 | P | Am going to manual proportional. |
| 00 12 58 | P | This is Sigma Seven. I am now in ASCS auto, retroattitude. Manual proportional works very well. |

## CANARY ISLANDS (FIRST PASS)

| | | |
|---|---|---|
| 00 14 31 | P | Canary Cap Com, this is Sigma Seven. Over. |
| 00 14 40 | CT | Sigma Seven, this is Canary Com Tech. Transmitting HF/UHF. Do you read? Over. |
| 00 14 46 | P | Roger. Canary Cap Com, this is Sigma Seven. Do you read me? |
| 00 14 50 | CC | Sigma Seven, this is Canary Cap Com. Reading you loud and clear. We have valid radar track. |
| 00 14 55 | P | Roger. Good show on radar. Awfully sorry our friend Julian couldn't be with us. I would like to give you my report on control mode. First off, manual and fly-by-wire, low, are excellent; aux damp works excellent. I am now in auto mode; retroattitude. Attitudes holding beautifully. I am go. My suit temperature is going up a bit. I have set it at 4.5. Over. |
| 00 15 29 | CC | Roger. I copied suit temperature at 4.5. What does your suit temperature read? |
| 00 15 33 | P | Negative. That was suit dome—is reading 75 [degrees]. I have set the suit at 4.5. |



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| | | |
|---|---|---|
| 00 15 43 | CC | Roger. |
| 00 15 44 | P | I am checking on my cabin. It's about 60 [degrees]. I am going to leave it alone. The cabin heat exchanger is about 48 [degrees]. |
| 00 15 54 | CC | Roger. |
| 00 16 02 | P | Canary, as far as I am concerned all control systems are perfect. The manual was slightly sluggish as predicted, but better than I have seen |
| 00 16 14 | CC | Roger. Are you on UHF-high at this time? |
| 00 16 19 | P | That is affirmative, and will be switching to UHF-low for a check with you shortly. |
| 00 16 24 | CC | Roger. |
| 00 16 30 | P | I have made an electrical check. We had communication problems on the way across. And all the systems checked out very well. Oxygen is holding up very well. I will give the suit circuit a little more time to cool down. |
| 00 16 50 | P | My suit temperature at this time is 68 [degrees]. I am not worried about it yet. |
| 00 16 56 | CC | Roger. |
| 00 17 00 | P | Everything else is green. |
| 00 17 03 | CC | Roger. |
| 00 17 07 | P | I am going to go to gyros free for a $T_s+5$ check. |
| 00 17 11 | CC | Roger. |
| 00 17 20 | CC | I have a [recovery area] 2–1 retrosequence time if you want it. |
| 00 17 24 | P | Roger. Stand by. |
| 00 17 26 | CC | 01 28 21. |
| 00 17 30 | P | Roger. Correction to 2–1. 01 28 21. |
| 00 17 36 | CC | That's confirm. |
| 00 17 37 | P | Roger. |
| 00 17 53 | P | Okay. Looks like the dome is coming down a little bit. I'll stick with this setting for awhile. |
| 00 18 00 | CC | Which dome is that? |
| 00 18 01 | P | That is the suit dome. The cabin dome is 55 [degrees]. |
| 00 18 07 | CC | Roger. 5. |
| 00 18 10 | P | Canary Cap Com. this is Sigma Seven. Do you read? |
| 00 18 12 | CC | I copy cabin dome setting at 5.5 and suit dome at 4.5. |
| 00 18 18 | P | Now those are not settings. Let me go over that. Suit dome temperature is 75 [degrees]. Cabin dome temperature is 56 [degrees]. Suit setting on the coolant valve is 4.5. Cabin setting is 4. Do you understand? |
| 00 18 40 | CC | I copy now. |
| 00 18 41 | P | Okay. Going back to gyros normal. $T_s+5$ confirmed. |
| 00 18 46 | CC | Roger. |
| 00 18 57 | P | I see we're coming across the coast. I haven't used the periscope too much as yet. |
| 00 19 04 | CC | Roger. Are you on UHF-high yet—or low yet? |
| 00 19 08 | P | Negative. I will switch to low now before I lose you. VOX off. |
| 00 19 37 | P | Canary Cap Com, Sigma Seven. On UHF-low. How do you read? |

## KANO (FIRST PASS)

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|---|---|---|
| 00 20 25 | P | Kano Cap Com, this is Sigma Seven. On UHF-low. How do you read? Over. |
| 00 21 01 | P | Kano Cap Com, Kano Cap Com, Sigma Seven. UHF-low. How do you read? |
| 00 21 12 | CT | Sigma Seven, Sigma Seven, this is Kano Com Tech transmitting on UHF/HF. Do you read? Over. |
| 00 21 19 | P | Roger. Kano Cap Com. Do you read me? UHF-low. Over. |
| 00 21 23 | CT | Roger. Standby this frequency, Seven, for Cap Com. |
| 00 21 27 | P | Okay. |
| 00 21 33 | CC | Hello Sigma Seven, this is Kano Cap Com. Standing by for your short report. |
| 00 21 38 | P | Roger. I am go. All systems are go. I am in ASCS auto; maneuver is off. My $T_r-10$ bypass is to normal. The fuel and oxygen are all green. Everything is green. I am fat here. I would like a c.e.t. time check. |
| 00 22 00 | CC | Understand you want a c.e.t. ground check. |
| 00 22 02 | P | That's correct. |
| 00 22 04 | CC | Roger. At my mark it will be 22 10. MARK. [00 22 10]$^{T}$. |
| 00 22 12 | P | Roger. I am right on. |
| 00 22 15 | P | I am changing my suit setting to almost 5. Over. |
| 00 22 22 | CC | Understand. Changing suit setting to number 5. |

| | | |
|---|---|---|
| 00 22 27 | P | That is correct. The dome temperature is at this time approximately 77 [degrees]. I will leave it at number 5 for at least 10 minutes. |
| 00 22 54 | CC | Kano Cap Com standing by for any further reports, Sigma Seven. |
| 00 22 57 | P | Roger. Kano. Looks like you got good weather down there. |
| 00 23 01 | CC | That's affirm. Do your attitude displays check with your visual reference? |
| 00 23 10 | P | Very well. I noticed that the yaw reticle is performing quite well. I've been using it crossing land here. |
| 00 23 19 | CC | Roger. Understand. |
| 00 23 23 | P | I am going to try some of the periscope now. Rather unusual sight through the periscope. Not as thrilling as through the window, I'll have to admit. |
| 00 23 42 | CC | Understand. |
| 00 23 44 | P | Looks like we are coming up on some cloudy weather. |
| 00 24 07 | CC | Seven, our telemetry pitch attitude shows about 27 [degrees] minus and your scanner output shows about—oh, −36 [degrees]. |
| 00 24 17 | P | Roger. I'm right on −34 [degrees]. It correlates with the window reference mark and I feel quite content we are right on. |
| 00 24 28 | CC | Very good. |
| 00 24 30 | CC | How is your suit temperature doing now? |
| 00 24 32 | P | The suit temperature is now . . . still going up a little bit, it's about 72 [degrees]. I am setting at suit . . . number 5 and I'll give it a little more time to try to cool down. |
| 00 24 55 | P | As soon as we have got a reverse in flow of this dome temperature we'll have a cut at it, I think. |
| 00 25 00 | CC | Roger. |
| 00 25 01 | P | Okay, we are picking up some pretty fair clouds now. |
| 00 25 13 | P | My inverters look real good. |
| 00 25 15 | CC | Roger. Understand. What does your suit dome temperature look like now? |
| 00 25 20 | P | It looks like it is holding. I may have to increase it after a little while. I'll let it sit for awhile. |
| 00 25 34 | CC | All the T/M systems look good, Seven. |
| 00 25 36 | P | Roger. I think the only problem I have is the suit circuit. I'll work on it for awhile and see how we are. |
| 00 25 43 | CC | Takes a wee bit of time for that to stabilize? |
| 00 25 46 | P | Right. That's what I am trying to do. |
| 00 25 57 | P | The dome now is still holding at 78 [degrees]. I think I will let it set for a little bit longer. |
| 00 26 06 | CC | Say again that temperature. |
| 00 26 08 | P | The suit dome is 78 [degrees]. |
| 00 26 11 | CC | Understand. |
| 00 26 17 | P | Cabin dome is 60 [degrees]. |
| 00 26 48 | P | Cabin dome—Kano, this is Sigma Seven. Do you read? |
| 00 26 52 | CC | LOS, Seven. |
| 00 26 54 | P | Roger. Cabin dome is working very well. It's just fluctuating. |
| 00 27 04 | CC | Roger. |
| 00 27 05 | P | It goes between 52 and 58 [degrees]. And I owe Frank Samonski, so far at least, 50 cents. |
| 00 28 48 | P | At this time, I have three axes practically on retroattitude. The yaw through the reticle usually observed as a rate and I am now trying to check for a change in attitude in yaw. I do notice that one cloud, even, gives you an attitude immediately as a reference. It's almost too accurate for the actual observation that I have within the capsule. |
| 00 29 39 | P | I am now going to low mag. Correction, high mag on the periscope [to] see how it looks . . . yawed right about 5 degrees. See how she matches up with the periscope at this point. Say, we have the yaw axes [indicator] at about 10 degrees right, at this time, and clouds are tracking right up the line, as if the yaw axes might be off by as much as 5 to 6 degrees. Now this may be a minor problem; we will have to observe it. |

## ZANZIBAR (FIRST PASS)

| | | |
|---|---|---|
| 00 30 28 | CT | Sigma Seven, Sigma Seven, . . . HF and UHF. |
| 00 30 35 | P | Hello, Kano. This is Sigma Seven. You are both coming in broken but clear. Over. |
| 00 30 42 | CT | Sigma Seven. Standby for Cap Com. Over. |
| 00 30 44 | P | Roger. |
| 00 30 47 | CC | Sigma Seven, Sigma Seven, this is Zanzibar Cap Com. Over. |
| 00 30 53 | P | Kano Cap Com, you are coming in weak and broken. Over. |

| | | |
|---|---|---|
| 00 30 59 | CC | This is Zanzibar Cap Com, Zanzibar Cap Com. Over. |
| 00 31 03 | P | Roger. Zanzibar. Sorry I miscalled you. I am going to set my . . . setting on the suit coolant valve to 5.5. Over. |
| 00 31 23 | P | Zanzibar, this is Sigma Seven. Do you read? |
| 00 31 27 | CC | Seven, this is Zanzibar. You were cutting out. I didn't get your last message. Will you repeat? |
| 00 31 32 | P | Roger. Standby, I'm switiching to UHF-high. |
| 00 31 36 | CC | Roger. |
| 00 31 58 | P | Hello, Zanzibar, this is Sigma Seven. How do you read? Over. |
| 00 32 02 | CC | Seven, this is Zanzibar Cap Com. Read you loud and clear now. Go ahead. |
| 00 32 05 | P | Roger. I have set my suit control valve to 5.5. The suit dome temperature is 80 [degrees]. Over. |
| 00 32 19 | CC | Roger. Understand. |
| 00 32 20 | P | The cabin dome is 55 [degrees] and is apparently under control. |
| 00 32 27 | CC | Roger. Understand. |
| 00 32 30 | P | My suit temperature has come down to 75 [degrees] at this time. |
| 00 32 36 | CC | Roger. |
| 00 32 38 | P | In fact, that's a correction, it hasn't come down. It's just going there. I would like to give you a briefing on my control mode. I am in auto mode, the bypass switch is normal, maneuver off. Fuel is in the green. Oxygen is way in the green. All electrical is in the green. |
| 00 33 03 | CC | Roger. Seven. Your [recovery area] 2–1 retrosequence time is 01 28 21. Over. |
| 00 33 20 | CC | Seven, Zanzibar. |
| 00 33 21 | P | Roger. I'm sorry I was trying to get my card out. I understand 01 28 21. |
| 00 33 25 | CC | Yeah. |
| 00 33 27 | P | Okay. |
| 00 34 39 | CC | . . . Zanzibar. |
| 00 34 41 | P | Go ahead, Zanzibar. |
| 00 34 44 | CC | All systems are green here on the ground. We get a good T/M. |
| 00 34 52 | P | Roger. Zanzibar. I'm all green here. I'm still working on the suit current circuit. |
| 00 35 02 | CC | Roger. How do you feel? Uncomfortable? |
| 00 35 05 | P | I feel quite comfortable. I'm a little warm. Particularly from sunlight but other than that I feel fine. |
| 00 35 13 | CC | Roger. |
| 00 35 14 | P | I am holding the suit control setting at 5.5 for a little longer. |
| 00 35 22 | CC | Roger. You changed that over Kano awhile ago. Affirmative. |
| 00 35 24 | P | That's correct. Looks like you got pretty good weather down there, too. |
| 00 35 33 | CC | Very good. |
| 00 35 34 | P | I've got a lot of good clouds for yaw checks. I'll say that. |
| 00 35 37 | CC | Right. |
| 00 35 38 | P | Would you check your yaw reading on what you read for me in yaw at this time? |
| 00 35 48 | CC | Roger. We are getting about a +5 degrees. Over. |
| 00 35 51 | P | Roger. Concur. I am trying to come back toward 0 [degrees] now. |
| 00 36 01 | CC | Roger. We are pulling you right back to 0 [degrees] now. |
| 00 36 03 | P | Okay. That's the—that's the ASCS system doing it for me, of course. I'm going to have to increase the suit setting. I'm just barely breaking even. I'm going to set the suit control valve to number 6. |
| 00 36 18 | CC | Roger. Understand. It's been about 10 minutes. |
| 00 36 22 | P | Roger. Thank you. The cabin is holding very well on settings, and I'm perfectly comfortable there. |
| 00 36 57 | CC | Seven, this is Zanzibar. We have LOS in approximately 1 minute. Anything else to report? |
| 00 37 03 | P | Nothing. I will keep the suit setting at this point until it gets a little hotter. If it does, I may have to go up another half notch at about 45 [minutes], before I get to Woomera. |
| 00 37 15 | CC | Roger. Understand. I would like a reading on that before we get LOS please. |
| 00 37 19 | P | Roger. My system is 6. The dome is 81, 81 [degrees]. |
| 00 37 44 | CC | Seven. All systems are still performing well here on the ground. |
| 00 37 47 | P | Roger. |
| 00 38 11 | P | This is Sigma Seven. Somebody broadcasting in the blind. I do not read you too well. |
| 00 38 18 | CC | Seven, this is Zanzibar. Read you 5 by. |

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|---|---|---|
| 00 38 20 | P | Roger. You are garbled. I will give you an HF call shortly. |
| 00 38 25 | CC | Roger. |
| 00 38 48 | CC | Zanzibar Cap Com. In the blind. How do you read? Over. |
| 00 38 57 | P | This is Sigma Seven. I read you. It's rather . . . very garbled. I did not observe my HF antennas on turnaround. The rates were just too much smaller, I assume. I am going to switch now to VOX off and go to HF. |
| 00 39 45 | P | Canary Com Tech, Canary—correction. Zanzibar, Zanzibar, this is Sigma Seven. On HF. How do you read? Over. |
| 00 40 11 | P | Hello Muchea, hello Muchea Cap Com, this is Sigma Seven. HF. How do you read? Over. |
| 00 41 00 | P | This is Sigma Seven. I have noticed minute objects that I can knock off the capsule one or two, in the bright sunlight at c.e.t. 41 10. |
| 00 41 17 | CT | Seven, this is Zanzibar. I barely read you HF check. Over. |
| 00 41 23 | P | Roger. Zanzibar, I read you loud and clear at this time. That is at 41 30, Zanzibar, getting HF loud and clear. |
| 00 41 43 | P | Muchea Cap Com, Muchea Cap Com. Sigma Seven HF. Over. |
| 00 41 49 | P | I am switching to push-to-talk. |
| 00 42 00 | P | Muchea Cap Com, Sigma Seven. HF check, push-to-talk. Over. |
| 00 42 36 | CT | . . . |
| 00 42 51 | ? | 12 53 00. He talked to Guaymas after we finished and IOS picked him up. Out. |
| 00 43 01 | P | The last station that talked on HF, I could not identify. It came in very clear and should be recorded aboard the capsule at approximately 43 minutes, 10 seconds elapsed time. |
| 00 43 24 | P | I have switched to VOX transmit and record. I am satisfied that I can see yaw through the window on ASCS without the use of the reticle by letting images come up from all sides. It's only a matter of a short period of time before objects show translation immediately. |
| 00 44 07 | P | The pitch scribe mark does indicate up a little bit and as a result matches the retroattitude, which at this time, is 30 degrees. I am now yawed right approximately 10 degrees, and it looks like I am tracking right down the line. |
| 00 44 35 | P | I am at 45 minutes. I am going to increase the suit setting knob just a small amount, about a quarter of a turn. I think we almost have control of the situation. I have set the suit knob at 6.25. The dome temperature at this time is 82 [degrees]. Suit inlet is 76 [degrees]. |
| 00 45 10 | P | I definitely can see a right roll at this time of about 5 degrees, and I noticed the periscope is dark, meaning we are coming into the dark side. I will attempt to look for the changes through the periscope for any observations. At this time, I can see nothing through the periscope for night observation, at least in this attitude. I'm not even sure when I have low mag, other than the position of the lever. The window is cloudy. I have sunlight on it now and it definitely has been clouded over by the escape tower rocket, not to a great degree. I am seeing the so-called fireflies drift dramatically at this point. I tried a couple of knocks and they definitely have a relative velocity to the vehicle, but apparently are part of the same orbital system. I definitely see them as white objects. |
| 00 46 39 | P | I would like to take some water to drink at this point, but I would rather keep the visor shut to keep the system attempting to cool down. We may make some progress on the cold side. It looks like I am going to have to decrease the cabin, it's gone down to 45 [degrees] dome. I'm coming to 3.5 on the cabin. |
| 00 47 03 | P | Checking on inverters at this time. They look very good. 150 is 102 [degrees]. 250 is approximately 107 [degrees]. Going back to cabin heat exchanger. |
| 00 47 24 | P | Coming into the night side now at approximately 47 minutes elapsed time. I set the cabin suit to 3.5. The suit dome is now just, correction—the cabin dome is nearing 50 [degrees] again. I will leave that setting at 3.5 for a period of time. |
| 00 48 19 | P | With this much sunlight, I cannot see stars at all. Sun is off to my left and I am getting close to sunset at approximately—49 is the schedule time. That's just about right on. I'm approaching 49 and the cabin lights are on white. I am going to switch the cabin lights to red. And turn off that blasted lift-off correlation clock light. |
| 00 49 03 | P | Oh, I almost missed my first sunset trying to get the right cabin light off. It is rather rapid as I was told it would be. I am not able to—there I have got Arcturus right on the right side where it belongs. Very nice. I should be able to pick up Muchea shortly, at 50. Having trouble seeing the clock at 49 minutes. |

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|---|---|---|
| 00 49 44 | CC | Sigma Seven, Sigma Seven, this is Muchea Cap Com. Do you read? Over. |
| 00 49 49 | P | Muchea Cap Com. Sigma Seven. HF. I read you loud and clear. Over. |
| 00 49 54 | CC | Roger. You are loud and clear also. How do you feel? |
| 00 49 58 | P | I feel very good, Gene. I am on HF at this time with the dipole. The—I've readjusted the cabin setting. It—the dome went down to about 45 degrees. I set the cabin at 3.5 as the cabin coolant valve setting. Do you understand? |
| 00 50 22 | CC | You set the cabin at 3.5. Is that correct? |
| 00 50 25 | P | That's right because it is reading a little low. On the suit, I am now at 6 and I am going to increase to 6.5. I am not making much progress. I went to about 6.25 about 5 minutes ago and I'm now setting the suit control to 6.5. The dome is reading 82 [degrees]. |
| 00 50 50 | CC | Checked the dome temperature on the suit is 82 [degrees] and you have just now set to 6.5. Do you feel too hot or anything? |
| 00 50 58 | P | No. I have beads of perspiration on my lips. That's about all. |
| 00 51 07 | CC | Can we have a suit temperature . . .? |
| 00 51 10 | P | Say again. |
| 00 51 12 | CC | Roger. Go ahead with status report. Over. |
| 00 51 15 | P | Okay. I am in auto mode at this point. Everything is acting perfectly. The maneuver switch is off. The systems are all green. I'm practically using no auto fuel. My only problem area is the suit circuit, which I am monitoring very carefully. |
| 00 51 36 | CC | Roger. Sigma Seven, I'll now give you an emergency voice check. The next transmission will be on emergency voice. |
| 00 51 46 | P | Roger. |
| 00 51 50 | CC | Sigma Seven, Sigma Seven, this is Muchea Cap Com on emergency voice. Do you read? Over. |
| 00 51 56 | P | This is Sigma Seven. Read you loud and clear, Gene, on emergency voice. Very good. I am setting it down at about volume level 4. |
| 00 52 04 | CC | Roger. |
| 00 52 06 | P | I'll give you a blood pressure. |
| 00 52 08 | CC | Roger. |
| 00 52 15 | CC | Has anybody asked you yet to drink water, Sigma Seven? |
| 00 52 18 | P | Negative. I've tried not to get into that. If I can get the suit temperature down a little bit, I'll open the visor and get some water then. |
| 00 52 25 | CC | Roger. Understand. Status of the Woomera flare test is okay. They are going to light them, but there is broken clouds and light rain. No lightning reported. They will fire flare. |
| 00 52 38 | P | Is the place covered with clouds? Over. |
| 00 52 43 | CC | Negative. Broken clouds—the last estimate I got was 0.8 and several breaks. |
| 00 52 50 | P | Roger. Understand. |
| 00 52 54 | CC | Sigma Seven, will you give us a cabin heat exchanger temperature, please. Over. |
| 00 52 58 | P | Roger. That is 41 degrees. Over. |
| 00 53 05 | CC | Roger. Understand. Your body temperature readouts on the ground are not good. We are not paying any attention to your body temperature readouts. Over. |
| 00 53 16 | P | Roger. I understand. |
| 00 54 09 | CC | Sigma Seven, this is Muchea. What is your suit dome temperature again? |
| 00 54 13 | P | It is now holding at 82 [degrees], at a coolant setting of 6.5. Over. |
| 00 54 23 | CC | Say again—being interfered with there. Will you repeat? |
| 00 54 29 | P | Roger. My dome temperature is 82 [degrees]. My coolant . . . 82, number 82. |
| 00 54 43 | CC | Sigma Seven. Your transmissions are now very noisy. We will stand by and not contact you for awhile. You are due to contact Woomera in about 3 minutes. |
| 00 54 57 | P | Roger. |
| 00 55 08 | P | Woomera, this is Sigma Seven. Over. |
| 00 55 13 | CC | Go ahead. Sigma Seven. |
| 00 55 15 | P | Is this Muchea or Woomera? |
| 00 55 17 | CC | Muchea. You are coming in much better now. |
| 00 55 19 | P | Roger. I have the moon right in the center of my field of view. It's a marvelous yaw reference. Just no sweat on it at all. |
| 00 55 29 | CC | Roger. Understand. Very good yaw reference. |
| 00 55 32 | P | That's affirmative. I'm still on automatic control. I'm going to switch to fly-by-wire shortly. |

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| 00 55 41 | CC | Roger. We will standby and expect you to report control mode when you change to fly-by-wire low, and gyros free. |
| 00 54 49 | P | I am switching—My cabin to working okay. The suit is okay. I'm going to go down for the yaw check. Correction, for the flare check now. I'm pitching down in fly-by-wire low. |
| 00 56 05 | CC | Roger. Understand. |
| 00 56 12 | P | Fly-by-wire low working very well. Trying to hold −40 [degrees in pitch]. Correction, −50 [degrees]. |
| 00 56 27 | CC | Roger. |
| 00 56 29 | P | Setting is −50 [degrees]. Gyros are free. Holding at −50 [degrees]. Standing by for flare. Roll and yaw are holding. I see the flare on my left which is kinda wrong, I think. I think I saw a flash of lightning. Probably—that is lightning I'm seeing, not the flare. I'm seeing more lightning. It's going to be hard to tell what I am seeing, whether it's lightning or flares. |

WOOMERA (FIRST PASS)

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| 00 57 09 | CC | Sigma Seven, this is Woomera Cap Com. Over. |
| 00 57 12 | P | Roger. Woomera. Go ahead. |
| 00 57 15 | CC | This is Woomera Cap Com. Flare ignition will be in 1 minute 20 seconds. |
| 00 57 20 | P | That's one reason why I can't see it, because I am looking at lightning, obviously. |
| 00 57 25 | CC | And I didn't receive your gyro switch position. |
| 00 57 29 | P | Roger. I am in fly-by-wire low and I have gyros free. |
| 00 57 37 | CC | Roger. |
| 00 58 08 | P | There appears to be no trouble at all in tracking the gyros. The—there was a large problem for me in trying to get the right cabin light dimmed down to red. It's very hard to reach due to ditty bag. I have not even messed around with the camera. I don't intend to until I have the suit circuit under control. |
| 00 58 35 | CC | Roger. You have 5 seconds to flare ignition. |
| 00 58 39 | P | Roger. I am tracking −50 degrees pitch. |
| 00 58 42 | CC | Ignition now. |
| 00 58 43 | P | Roger. I have lightning only. It looks like you're just about socked in. I'll stay here for a while and then come back up to ASCS shortly. I think I saw lightning right below me but it couldn't have been the flare. It should burn steadily as I understand it. |
| 00 59 03 | CC | Correct. |
| 00 59 07 | P | The lightning looks like a big blob, rather than a jagged streak we are use to seeing when earthbound. Just looks like a big—almost like an antiaircraft shot. A big blob of bright light, and then it fades out almost instantly. It definitely looks like you are overcast. By the way, how is my HF coming through to you all? |
| 00 59 35 | CC | Clear at Woomera. |
| 00 59 37 | P | Very good. I am on HF and dipole, as you may know. |
| 00 59 41 | CC | In fact, we picked you up when you began working Muchea. |
| 00 59 44 | P | You did? Very good. Well, looks like we got the poles out. |
| 00 59 48 | CC | Roger. |
| 00 59 57 | P | I think I'm going to—between you and Canton, will make another attempt at the suit temperature control. We, definitely, aren't making much progress. I'm holding my own. That's all. |
| 01 00 15 | CC | Roger. You're picking up a little plus yaw now. |
| 01 00 19 | P | Roger. I concur. I was looking for the flare. Are you lit now? |
| 01 00 24 | CC | From heresay. Have you found it? |
| 01 00 26 | P | Roger. I've got a steady light in sight. That's because I've pitched up though. Now, it looks like we're getting much clearer weather here. |
| 01 00 37 | CC | . . . |
| 01 00 41 | P | Must have some ground lights in sight here. |
| 01 00 53 | CC | Picking up some plus roll now. |
| 01 00 55 | P | Very good. I've been searching around a little bit for this. Okay, I'm going to hold that pitch still now. Holding the yaw still. Stopping roll. And I'm sorry I can't see your flare. I'm going to start pitching for ASCS. |
| 01 01 29 | CC | We have 10 seconds of flare left, and Cape requests your suit temperature. |
| 01 01 36 | P | Say again. |
| 01 01 45 | CC | Requesting your suit inlet temperature and dome temperature. |

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| 01 01 49 | P | Roger, my suit inlet is 78 [degrees], my dome temperature is 82 [degrees]. |
| 01 02 00 | CC | Sigma Seven, this is Woomera Cap Com. Your transmission was not received. |
| 01 02 06 | P | Roger, my suit inlet is 78 [degrees]. |
| 01 02 07 | CC | What is your suit and dome temperature? |
| 01 02 22 | P | This is Sigma Seven. I say again. My suit inlet temperature is 78 [degrees]. My suit dome is 82 [degrees]. |
| 01 02 33 | CC | Okay. We got that. |
| 01 02 34 | P | Roger. I'm going to increase my setting to 7 on the coolant control on the suit. I'm now in automatic mode, gyros are normal. |
| 01 02 50 | CC | Suit setting at 7. |
| 01 02 52 | P | The suit coolant valve setting is 7. That is correct. |
| 01 02 56 | CC | Scanners and attitudes agree here. |
| 01 02 58 | P | Roger. I'm in orbit mode and tracking very well. |
| 01 03 03 | CC | Roger. We had T/M LOS. Correction, we've got it back. |
| 01 03 07 | P | Roger. I'm going to decrease the cabin setting. It's still running a little cool. |
| 01 03 20 | CC | Roger. |
| 01 03 22 | P | I will set the cabin at setting number 3. |
| 01 03 27 | CC | Roger. Number 3 for cabin. |
| 01 03 30 | P | I just set now, MARK, [01 03 31] $^T$ at number 3, and the suit is riding at number 7. |
| 01 03 38 | CC | Roger. And Woomera has had T/M LOS. We are standing by HF. |
| 01 03 47 | P | Roger. Am definitely see some white at this time under the overcast, and I'm sure it must be one of your major cities, possibly Brisbane. I'm not sure. |
| 01 04 06 | CC | All we got was, "under the overcast", on that transmission. |
| 01 04 10 | P | It looks like a city under the overcast. I'm not sure. At about—almost right in the middle of the window at this time. |
| 01 04 26 | CC | Sigma Seven, Woomera read your last transmission. |
| 01 04 57 | P | This is Sigma Seven. Going to fly-by-wire low and pitching up to reentry attitude. Selecting reentry on attitude select. |
| 01 05 56 | P | I'm now in reentry attitude. Standing by to go into automatic mode. Fly-by-wire tracks absolutely beautifully, just as it worked in the trainer. Very positive results from using the procudures trainer. There is no doubt about it, time does pass rather rapidly. Going back to automatic mode. I got pitch down signal, just a slight low thruster, and everything seems to be all right. This probably was a slight error in the corrected readout. I was right on, I believe, in all three axes. The capsule logic is working very well, and is tracking very well in reentry. |
| 01 06 50 | P | I will check my time as 1 plus 06 plus 50 seconds when I went into reentry attitude. The stars are very easy to see. I see quite a few, but am bothered by a considerable amount of red light. I, now, am going to devote some attention to the suit circuit for a minute or so. Then prepare to go back into retroattitude for Canton. |
| 01 07 28 | P | One definitely gets the illusion of looking way up above you at this attitude, and if there is no horizon, it's just a black sky. The amount of light in the cockpit is quite high. Once one gets adapted and it can be reduced, of course, by the cabin light. At this point, I am somewhat reluctant to reduce the light level in here, due to the problem with the suit circuit. I'm using my fingertip lights liberally. It is observed that in future flights, we must have some catch-all device that we can stuff objects into, and have them trapped there for a period of time. I'm driving at the problem of the washer and small crimped piece of metal. I . . . believe I finally got them stuffed into the little bag on the hatch. Suit temperature is just holding its own. I am hot, and probably will have to decrease the setting. I am sure I don't understand why the suit circuit takes so long to react. My cabin circuit works beautifully. I'm going to go back to fly-by-wire low; select retroattitude; and fly to retroattitude. |

CANTON (FIRST PASS)

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| 01 09 16 | CT | Sigma Seven, Sigma Seven, this is Canton Com Tech. Do you read? Over. |
| 01 09 21 | P | Canton, this is Sigma Seven. I read you. At this time, I am in fly-by-wire low, pitching down to retroattitude for ASCS. Over. |
| 01 09 35 | P | Canton Cap Com, Canton Cap Com. Sigma Seven. |
| 01 09 42 | CT | Sigma Seven, Sigma Seven, this is Canton Com Tech. Do you read? Over. |
| 01 09 46 | P | Canton Com Tech, this is Sigma Seven. I read you loud and clear. How me? |
| 01 10 03 | CT | Sigma Seven, this is Canton Com Tech. Do you read? |

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| 01 10 07 | P | Canton Com Tech, Sigma Seven. Read you loud and clear. |
| 01 10 24 | CT | Sigma Seven, Sigma Seven, this is Canton Com Tech. Do you read? Over. |
| 01 10 28 | P | Canton Com Tech, this is Sigma Seven. Read you loud and clear. How me? |
| 01 10 39 | P | Canton Com Tech, Canton Com Tech. Sigma Seven. Loud and clear. How me? Over. |
| 01 10 49 | CC | Sigma Seven. This is Hawaii Cap Com. |
| 01 10 52 | P | This is Sigma Seven. Go ahead. |
| 01 10 59 | CC | Sigma Seven, this is Canton Cap Com. Over. |
| 01 11 03 | P | Canton Cap Com, this is Sigma Seven. How do you read me? Over. |
| 01 11 46 | P | Canton Com Tech, Canton Com Tech, this is Sigma Seven. UHF-high. Over. |
| 01 11 54 | CT | Sigma Seven, this is Canton Com Tech. Do you read? Over. |
| 01 11 58 | P | Canton Com Tech, this is Sigma Seven. I'm on UHF-high. How do you read? Over. |
| 01 12 27 | P | Canton Com Tech, Canton Com Tech. Sigma Seven. Over. |
| 01 12 34 | CT | Sigma Seven, this is Canton Com Tech. I read you 3 by 3. Over. |
| 01 12 39 | P | Roger. Status report. I have sent you a blood. All systems are green, but for suit circuit, which I am working on carefully. I am in ASCS retroattitude; gyros normal; maneuver off. I am working on the suit circuit. I am still holding setting number 7. Over. |
| 01 13 05 | CC | Sigma Seven. Repeat. I got your status green; ASCS retro; gyros are normal; holding at 7. Repeat all others. |
| 01 13 17 | P | Roger. I am holding the suit coolant valve setting, George, at number 7. Over. |
| 01 13 25 | CC | Say again. Holding suit at what and what? |
| 01 13 29 | P | The coolant valve setting is at number 7. The coolant control valve for the suit circuit. |
| 01 13 39 | CC | Roger, Sigma Seven. Would you give me your standard report again. Over. This is Canton Cap Com. |
| 01 13 47 | P | Roger, Canton. You did read that I was in ASCS retro? You did read that I had my maneuver off? You did read my gyros were normal? I'd like to get the suit circuit discussed. Everything else is green. |
| 01 14 05 | CC | Roger, Sigma Seven. Go ahead. |
| 01 14 08 | P | I have the suit setting for the control valve at number 7. I have the suit dome temperature of 82 [degrees]. I have suit inlet of 78 [degrees]. Do you understand? |
| 01 14 26 | CC | Roger, Sigma Seven. I understand. |
| 01 14 29 | P | I am increasing my suit setting at this time to 7.5. Over. |
| 01 14 37 | CC | Roger, Sigma Seven. Understand increasing your suit setting to 7.5. Over. |
| 01 14 44 | P | That is affirmative. |
| 01 14 55 | CC | Sigma Seven. Request you push stop button on your blood pressure. Over. |
| 01 15 00 | P | I have done that. I just didn't come through right. Did that clean up the trace? Over. |
| 01 15 12 | CC | Say again. Over. |
| 01 15 13 | P | Is your EKG okay now? |
| 01 15 17 | CC | Roger, Sigma Seven. |
| 01 15 30 | CC | Sigma Seven. How do you feet right now? Are you hot? |
| 01 15 35 | P | Not uncomfortably hot, but just a little warm. I'm trying not to take a drink of water until I can get this suit circuit under control. If I can't get it under control right away, I will be drinking some water. |
| 01 15 48 | CC | Roger, Sigma Seven. |
| 01 17 05 | P | Canton Cap Com. Sigma Seven. Over. |
| 01 18 27 | P | Boy, this is a wrestling job with this ditty bag. |
| 01 18 33 | P | I'd just as soon not even go into it. Finally got one dosimeter out, and will have to put it up on the hatch and it's the—let me Mark, wait one, I can't even see anything on it. |

## HAWAII (FIRST PASS)

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| 01 18 59 | CC | Sigma Seven, Sigma Seven. Hawaii Cap Com. Calling HF. |
| 01 19 07 | P | This is Sigma Seven. Sigma Seven on UHF-high. Does anybody read? Over. |
| 01 19 19 | CC | Sigma Seven, Sigma Seven. Hawaii Cap Com on HF. |
| 01 19 25 | P | VOX off. |
| 01 20 03 | P | This is Sigma Seven on HF. Hawaii. Do you read? Over. |
| 01 20 09 | CC | Roger. Sigma Seven . . . . |
| 01 20 14 | P | Hawaii. You're coming in broken. I cannot read you. I'm handling HF at this time. Over. |
| 01 20 54 | P | There's Jupiter. |

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| 01 21 16 | P | Guaymas Cap Com, Guaymas Cap Com, this is Sigma Seven. On HF. Do you read me? Over. |
| 01 24 12 | P | Hello, Guaymas Cap Com, Guaymas Cap Com. Sigma Seven. HF. Over. |
| 01 24 40 | P | I'm now starting to see the sunrise in the periscope. First light in the periscope during this particular orbit as a result of the night side. It is obvious that the periscope has no function whatsoever in retroattitude on the night side. First light that I get is right now at a c.e.t. of practically 1 25—1 hour and 25 minutes. The sunrise is coming in rather rapidly through the periscope. I do have the lighted objects that John mentioned, and I can create some by knocking them off. I definitely have a sensation of their being a field and varying in size from small to bright. The periscope itself is blinding me. I'll have to put the chart on it, so I can see out the window. I am in condition for retro at any time, so I have nothing else to do but look out this window, assuming that the suit circuit is satisfactory. That chart helps no end to cover up that blasted periscope. Quite a large field of these objects. Definitely is confirmed that you can knock them off the hatch, as Scotty said. And they stream off at, definitely there is no problem in judging that they are going away from the capsule, at a different rate than you are. They are definitely going slower, in velocity, than the capsule itself. One rap, and you can see them sliding aft. They are too small an object for photography. I would not even attempt to take a picture of them. Retroattitude s beinig held very well by the ASCS. I should be able to reach Guaymas by now. |

GUAYMAS (FIRST PASS)

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| 01 26 52 | CT | Guaymas Com Tech on HF/UHF. Do you read? Over. |
| 01 26 56 | P | Guaymas Cap Com, Guaymas Cap Com, this is Sigma Seven. Over. |
| 01 26 59 | CC | Guaymas Cap Com, reading you 3 by 3. Give me a quick rundown on how you feel, Wally, and suit and dome and inlet temperatures, please. |
| 01 27 09 | P | Right, Scott. I feel fine. I'm sure we're getting in on this suit circuit. The dome temperature is holding now. It's just about 81 [degrees]. I'm making a change in it. The suit inlet temperature is at about 78 [degrees]. I think another cut at the controls will solve this problem. |
| 01 27 29 | CC | Roger. Say again your suit inlet temperature, please, and what is your control setting? |
| 01 27 34 | P | Roger. The suit inlet is 78—78 degrees. The setting is exactly 7.5 on the circuit control valve. |
| 01 27 46 | CC | Roger. |
| 01 27 50 | P | Scott, I feel we're in very good shape for one more orbit at least, and we'll see how we can hack this suit circuit here. |
| 01 27 58 | CC | Understand, Wally. We have a go. Are you ready to copy [recovery areas] 3–1 and 6–1 times? |
| 01 28 03 | P | Roger. Stand by. |
| 01 28 10 | P | Okay, Scott. |
| 01 28 12 | CC | Roger. 3–1 is 03 01 20. |
| 01 28 18 | P | Oh, back to 20 now. |
| 01 28 19 | CC | Roger. |
| 01 28 21 | P | Okay. |
| 01 28 23 | CC | 6–1 is 08 51 33. Read those both back and give me a standard report, please. |
| 01 28 29 | P | Will do. Okay. 3–1 is 03 01 20. 6–1 is 08 51 33. |
| 01 28 41 | CC | Right. The report, please. |
| 01 28 42 | CC | Okay, stand by. I'll stow this pencil. I'm in chimp configuration. The capsule is flying beautifully. All thrusters are working well. The gyro switch is normal. Maneuver switch is off. All systems are green on green; and I'm bird dogging the dome temperature at this time on the suit circuit. |
| 01 29 08 | CC | Okay, Wally, give me your cabin dome and cabin temperature. Also, your flow control setting on cabin, too. |
| 01 29 19 | P | Okay. I have cabin temperature of 100 [degrees], cabin dome, 40 [degrees]; cabin heat exchanger is 42 [degrees]; the setting on the cabin is 3 and it's holding steady for a long period of time. I'd rather not change that. |
| 01 29 40 | CC | Okay. And now your fuel and oxygen, please. |
| 01 29 43 | P | Okay. You want number? |
| 01 29 44 | CC | Roger. |

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| 01 29 45 | P | Okay. The numbers on fuel 100 [percent] for auto, 95 [percent] for manual, oxygen is 62 primary, 72 [psi, in hundreds] secondary. |
| 01 30 01 | CC | Roger. And on my mark the ground elapsed time will be 1 hour, 30 minutes, and 10 seconds. Stand by. MARK. [01 30 11]T. |
| 01 30 13 | P | I am exactly 1 second slow. Correction, I am 1 second fast. |
| 01 30 18 | CC | Roger. Understand. One second fast, and looks like you're good for another one, Wally. |
| 01 30 24 | P | Okay. And I saw some of John's friends up here; I'm afraid to say, although I knocked them off the way you did it. Ha! Ha! |
| 01 30 33 | CC | Roger. Interested in your report. |
| 01 30 34 | P | I imagine. John listening to some of that, too? |
| 01 30 38 | CC | Roger. |
| 01 30 41 | P | Basically, what I saw was the firefly color that John saw, which I could create at other times as white color. I'm definitely convinced it's capsule—a capsule derivative and once in a while, even now, I see one go by. |
| 01 30 59 | CC | Roger. That's good to hear. |
| 01 31 02 | P | I'm getting a very good yaw check with the yaw reticle in the ASCS mode. Having no trouble with that at all. |
| 01 31 12 | CC | Wally, are the particles luminous or reflecting? |
| 01 31 16 | P | Scott, I think they are reflecting. I'm going to go ahead now, Scott, and do some yaw check as long as I've got some good terrain to look at and leave the particles off for a while. |
| 01 31 27 | CC | Okay. We are just about . . . losing T/M. We're reading roughly 0, 0, and [minus] 34 [degrees] at this time. |
| 01 31 38 | P | Roger. Understand. |
| 01 32 26 | P | This is Sigma Seven. I am now commencing day yaw checks. I am—Guaymas. Do you read? Over. This is Sigma Seven. I'm going to send a blood pressure at this time. |
| 01 32 42 | CC | Sigma Seven, Guaymas Cap Com. Reading you on HF. |
| 01 32 47 | P | Roger. I'm going to fly-by-wire low at this time. |
| 01 32 52 | CC | Roger. You're loud and clear on HF now, Wally. |
| 01 32 55 | P | Roger, Scott. |
| 01 33 14 | P | I moved my left arm too much on that last transmission. I'll give another one a little later. |
| 01 33 20 | CC | Roger. |

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| 01 33 23 | CC | Sigma Seven, Cape Cap Com. How do you read? |
| 01 33 25 | P | Hi, Deke, I read you loud and clear. How me? |
| 01 33 27 | CC | You're coming in fairly good. |
| 01 33 32 | P | This reticle is working very well for yaw, as well as for almost any other attitude. |
| 01 33 49 | CC | Sigma Seven, Sigma Seven, this is Cape Cap Com. |
| 01 33 51 | P | Go ahead, Cape. |
| 01 33 55 | P | Cape Cap Com, go ahead. Cape Cap Com, this is Sigma Seven. I read you loud and clear. How me? |
| 01 34 11 | P | Sigma Seven, Sigma Seven, Cape Cap Com. |
| 01 34 14 | P | This is Sigma Seven. Go ahead, Cape, I read you loud and clear. |
| 01 34 18 | CC | You are coming in about 3 by. |
| 01 34 20 | P | Okay. |
| 01 34 23 | P | I'm okay. Stand by. I'm going back to ASCS. It's gotta hold me up [delay me]. The capsule—I'd like to straighten out this problem that you are—obviously have seen on the suit circuit. I have had very little luck in bringing it down. I'm going to in-increase the setting to 8 at this time. I am on 8 now—the suit dome is now about 81 [degrees]. It has dropped about a degree. Do you understand? |
| 01 35 02 | CC | Understand suit dome is 81 [degrees]. |
| 01 35 07 | P | That is correct. Suit dome is 81 [degrees]. The suit inlet is about 76 [degrees]. I'm making a little ground on it. |
| 01 35 15 | CC | That sounds promising. |
| 01 35 16 | P | Yeah, I think it is. I didn't want to rush into it, and I didn't get too hot. I know you are concerned. I'd rather come up on the right setting than dicker around going back and forth. |
| 01 35 27 | CC | Roger. |
| 01 35 28 | P | Now all the systems are working very well. I'd like to give you a rundown on the control systems. My fly-by-wire is excellent. Manual was slightly sluggish but very good. The capsule at this time is in auto mode, maneuver off, gyros normal. $T_s+5$ did check out very well. The fuel is holding up as you can see, as well as the oxygen. |
| 01 35 57 | CC | Okay, sounds good. |
| 01 35 58 | P | Okay. I'm going to continue with my day yaw checks now. |
| 01 36 02 | CC | Next transmission will be on emergency voice. |
| 01 36 06 | P | Roger. |
| 01 36 14 | CC | Sigma Seven, Cape Cap Com, transmitting emergency voice. Over. |
| 01 36 18 | P | Roger. I read you loud and clear. I'm going to send you another . . . [blood pressure] here, because I moved too much on the last one. |
| 01 36 27 | CC | Roger. |
| 01 36 52 | CC | Seven, Cap Com. |
| 01 36 54 | P | Go ahead, Deke. |
| 01 36 56 | CC | Your [contingency recovery area] 2 Bravo retro. |
| 01 36 58 | P | Stand by 'til I finish my blood here. Okay, I'm done. Okay, go ahead with your 2 Bravo. |
| 01 37 11 | CC | 2 Bravo, 01 48 32. |
| 01 37 15 | P | 48 32. Is that correct? |
| 01 37 22 | CC | 01 48 32. |
| 01 37 25 | P | 32 Roger. Understand. 01 48 32, 2 Bravo. |
| 01 37 32 | CC | We suggest you have a drink of water if you haven't had one recently. |
| 01 37 36 | P | No, I haven't. I've tried not to open the visor. I want to get the circuit going down. I think we might have a chance to take a quick one. I'll get ready for one. |
| 01 37 46 | CC | Okay. If you're reading this, I want to clear you on one item. |
| 01 37 49 | P | Okay. |
| 01 37 51 | CC | You indicated high thruster action at Bermuda and Muchea on switch over from ASCS to fly-by-wire. Has this been apparent to you? |
| 01 38 01 | P | Negative. It has not. I have one case where I went into reentry attitude after—correction, before—Canton but this was to check the stars at night after Woomera. And I got a twitch then, which I think was a high thruster. |
| 01 38 20 | P | Otherwise, it dropped in beautifully on transition from control mode to control mode. |
| 01 38 28 | CC | You're pretty poor transmitting, let's try UHF once. |
| 01 38 32 | P | Okay. Standby, VOX off. |
| 01 38 58 | CC | Seven, Cap Com, UHF. How do you read? |
| 01 39 12 | P | Deke. I read you loud and clear. How me? |
| 01 39 14 | CC | How you reading now? |

| | | |
|---|---|---|
| 01 39 17 | P | I read you fine. I just had some water and it does feel kinda good. |
| 01 39 21 | CC | Roger, loud and clear. |
| 01 39 25 | P | Say again. |
| 01 39 26 | CC | Looks more readable on UHF. |
| 01 39 27 | P | Okay. We'll use that around the pad. |
| 01 39 33 | CC | Have some Echo sighting data for you if you're interested. |
| 01 39 38 | P | Yeah, I'd like to hear about it. |
| 01 39 40 | CC | In the second orbit over Zanzibar, time 15 23 Zulu. Azimuth should be 2.30 [degrees], elevation 83.25 [degrees]. |
| 01 39 59 | P | Roger, we'll see if we can take a peek at it. |
| 01 40 04 | CC | Our recommendation is that you decrease suit valve to position 3 and observe dome temperature for 15 minutes. If this doesn't help, then go back to 7. |
| 01 40 15 | P | Deke, I finally got a grasp on this thing. I'm beginning to feel a little cooler. And the suit inlet temperature is now down to 76 [degrees]. Over. |
| 01 40 26 | CC | Roger. Understand you would prefer to maintain a status quo, is that correct? |
| 01 40 30 | P | No, I've been sneaking up on this thing for almost a whole orbit. |
| 01 40 36 | CC | Roger. |
| 01 40 38 | P | Do you understand? |
| 01 40 39 | CC | Roger. |
| 01 40 53 | P | Cape Cap Com, Sigma Seven. |
| 01 40 56 | CC | Go ahead. |
| 01 40 57 | P | I really do feel I am getting cooler. The suit inlet is now about 75 to 76 [degrees], so I am making progress. Over. |
| 01 41 08 | CC | Roger. Understand. You are getting a slight decrease. |
| 01 41 09 | P | That is affirmative. I would rather not throw in the sponge on the settings I have so far. |
| 01 41 18 | CC | Roger. Understand. You would prefer to let it stabilize a while longer. |
| 01 41 21 | P | Right. I'm going to go back to some more yaw checks. |
| 01 41 40 | P | Going to fly-by-wire low. |
| 01 41 44 | CC | Fly-by-wire low. |
| 01 41 45 | P | Roger. |
| 01 42 04 | CC | Sigma Seven, Cap Com. |
| 01 42 05 | P | Go ahead, Deke. |
| 01 42 07 | CC | Bermuda again shows high thruster action on switch over to fly-by-wire. |
| 01 42 12 | P | I'm positive I'm not getting it, because if—I'd be leaping all over—I'd be leaping all over the sky if I were getting highs at this point. I haven't used more than, oh, ½ degree per second. |
| 01 42 40 | CC | Sigma Seven, Cap Com. |
| 01 42 42 | P | Go ahead, Deke. |
| 01 42 47 | P | Go ahead, Cape Cap Com. |
| 01 42 50 | CC | Roger. You are fading. We are about at LOS. Flight would still prefer that you consider going to position 3 after evaluating 8 a while longer. |
| 01 43 02 | P | Roger. Understand. |
| 01 43 07 | P | Roger. I'm now getting into attitude. Stand by for 0 [degrees] yaw, and pitch and roll. This will be—— |
| 01 43 24 | P | Yaw is now approximately 0 at this time—MARK. [01 43 31] T. I will look—about 4 degrees left. Correcting in pitch, yaw is okay, going to go back to ASCS to get gyros straightened out, gyros are normal at this time. I'm setting up into the tight pattern. |
| 01 44 35 | P | Rates are just about right on, attitudes right on, going to fly-by-wire, gyros normal. At 1 44 50 approximately, we are back into chimp configuration. Understand I will have LOS at Bermuda; next station is Canaries. At this point suit temperature is now down to 75 [degrees], dome is still high. |
| 01 46 38 | P | On the 0—on the 0 to 50—on the 0 to 50 Roentgen scale at 01 hour 46 minutes, there is practically no reading at all. |

## CANARY ISLANDS (SECOND PASS)

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|---|---|---|
| 01 48 47 | CT | Sigma Seven, this is Canary Com Tech, transmitting UHF/HF. Do you read? Over. |
| 01 48 52 | P | Hello, Canary Com Tech, this is Sigma Seven. I read you loud and clear. How me? Over. |
| 01 48 57 | CC | Roger, Sigma Seven, this is Canary Cap Com, reading you loud and clear. We'd like to get some temperature readings from you. Cabin suit and cabin dome and suit dome. Over. |

| | | |
|---|---|---|
| 01 49 08 | P | Okay, I'll give you a readout. Suit dome is 80 [degrees], suit inlet temperature is 75 [degrees], cabin dome is 41 [degrees], cabin temperature is 97 [degrees], suit coolant setting is 8, cabin is 3. I will follow . . . . |
| 01 49 40 | CC | Do you feel that these settings now are giving you adequate cooling? |
| 01 49 44 | P | I am going to take Flight's suggestion, and reduce my setting to unit 3 for a few minutes, and then try at back 7 if this does not work. Over. |
| 01 49 56 | CC | Roger. I copied. |
| 01 49 57 | P | I am now going to setting number 3 on the suit temperature control. |
| 01 50 04 | CC | Roger. |
| 01 50 09 | P | At 1 hour and 50 minutes. |
| 01 50 12 | CC | Roger. What is your present control mode? |
| 01 50 23 | P | I am in ASCS. I have completed yaw checks with the window. I am going to try some yaw checks with the periscope at this time. |
| 01 50 34 | CC | Roger. |
| 01 50 39 | P | Switching to fly-by-wire low, gyros free. |
| 01 51 20 | P | I can definitely see a yaw pattern in the window, in the periscope, in the reticle. The window itself is satisfactory at [—] 34 degrees, I've covered the gyro and am now coming back to the left to remove yaw. |
| 01 51 44 | CC | Roger. Did you, how far did you have to come back on yaw? |
| 01 51 48 | P | I am not there yet. I'd say about 25 to 30 degrees, I'm stopping yaw at this time. The periscope checks with the window and the reticle and I'm going to give a mark shortly, to try to get all the rates stopped. I am just about in retroattitude now, and yaw looks real clean. I'm going to pull off and look. It's about 1 degree of yaw, to the right—MARK. [01 52 20]$^{T}$. Okay, I'm satisfied with that kind of day yaw check. That was done in retroattitude. I had a real good cloud layer, that was what was the cue. |
| 01 52 32 | CC | Roger. How do you feel about systems at the present time now? |
| 01 52 33 | P | All systems are green except for the suit cooling and it definitely is—the dome temperature is going up at this time. I'm going to go back on ASCS for a while and hack out a network. |
| 01 52 52 | CC | Roger. |
| 01 52 56 | P | I will not go to ASCS. Ah, by the way, how about taking a look at my high thrusters. Have you seen any high thruster action at all? |
| 01 53 04 | CC | Stand by. |
| 01 53 06 | P | I shouldn't have had any at all. |
| 01 53 12 | CC | Wally, did you already switch to ASCS? |
| 01 53 16 | P | Negative. I have not switched. |
| 01 53 18 | CC | Do it now. |
| 01 53 20 | P | Say again. |
| 01 53 24 | CC | Go ahead and switch. |
| 01 53 26 | P | I'm going—have I had any high thruster action so far? |
| 01 53 29 | CC | Negative. |
| 01 53 30 | P | Okay, that's good. I'm still in fly-by-wire low, standby switching now, flop. I'm going . . . . |
| 01 53 41 | P | Say again. |
| 01 53 42 | CC | No high thrusters. |
| 01 53 44 | P | Okay, good deal going, gyros normal. |
| 01 53 46 | CC | Roger, that is affirmative. |
| 01 53 49 | P | I have completed my day yaw checks. I am very satisfied with the technique of taking care of roll as I . . . . |
| 01 53 58 | CC | Sigma Seven, Sigma Seven, this is . . . . Do you read? Over. |
| 01 54 05 | P | This is Sigma Seven. I had to give up on this lower temperature. Everything's going up. |
| 01 54 11 | CC | Okay, I'll report that to the Cape. |
| 01 54 13 | P | I'm going to set in to number . . . . |

## KANO (SECOND PASS)

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|---|---|---|
| 01 54 15 | CT | Sigma Seven, this is Kano Com Tech, transmitting on UHF/HF, do you read? |
| 01 54 20 | P | Roger, Kano. I read you loud and clear. How me? |
| 01 54 24 | CC | . . . read you here. Report . . . setting number. |
| 01 54 27 | P | Okay. I've set it back to 7.5. |
| 01 54 32 | CC | Roger. I copied 7.5. |

| | | |
|---|---|---|
| 01 54 34 | P | The suit dome went up to 82 degrees. |
| 01 54 38 | CT | Sigma Seven, this is Kano Com Tech, transmitting on UHF/HF. Do you read? Over. |
| 01 54 44 | P | Could you read me, Canaries? |
| 01 54 49 | P | Hello Kano, hello Kano. |
| 01 54 52 | CT | Sigma Seven, Sigma Seven, this is Kano Com Tech, transmitting on UHF/HF. Do you read? Over. |
| 01 54 58 | P | Kano, I read you loud and clear. How me? Over. |
| 01 55 09 | CT | Sigma Seven, Sigma Seven, this is Kano Com Tech, transmitting on UHF/HF. Do you read? Over. |
| 01 55 16 | P | Kano, this is Sigma Seven. Read you loud and clear. How me? Over. |
| 01 55 18 | CC | Roger Seven, I read you weak but readable. Stand by this frequency for . . . . |
| 01 55 24 | P | Okay. |
| 01 55 32 | CC | Sigma Seven, . . . how do you read? |
| 01 55 34 | P | I read you loud and clear. I wonder whether Canaries got my last on the suit system. I've got 82 degrees on the dome and went back up to a setting of 7.5 on the coolant valve. Over. |
| 01 56 00 | CC | Sigma Seven, Kano Cap Com. |
| 01 56 03 | P | Go ahead, Kano. |
| 01 56 14 | P | Kano Cap Com, Sigma Seven. Go ahead. |
| 01 56 27 | P | Hello, hello Kano Cap Com, Sigma Seven. Over. |
| 01 56 55 | P | Kano Cap Com, this is Sigma Seven. Go ahead. |
| 01 56 59 | CC | Sigma Seven, Kano Cap Com . . . . |
| 01 57 08 | P | Kano Cap Com, this is Sigma Seven. Go ahead. |
| 01 57 14 | CC | Sigma Seven, we don't read you. |
| 01 57 16 | P | Roger, Kano. This is Sigma Seven. I read you loud and clear. Sigma Seven switching to HF. |
| 01 57 31 | CC | Sigma Seven, Kano Cap Com. |
| 01 57 43 | P | Kano, this is Sigma Seven.. Over |
| 01 57 47 | P | Hello, Kano Cap Com. Sigma Seven. Over. |
| 01 57 51 | CC | Roger, Sigma Seven. I have not read your transmissions. Over. |
| 01 57 55 | P | Roger. I had to switch to HF at this time, and am in VOX at this time. HF. How do you read? |
| 01 58 04 | CC | Negative, Seven. Would you say again? |
| 01 58 07 | P | I'm on VOX—correct, I am going to push-to-talk on HF. Do you read me now? |
| 01 58 13 | CC | Roger. I read you better now. |
| 01 58 16 | P | Okay. Do you want some suit stuff? |
| 01 58 18 | CC | Roger. How is your suit doing? |
| 01 58 20 | P | Okay. I've already caught the dome temperature. Went up to about 82 [degrees]. I've got it back to 81 [degrees]. The suit inlet went up to 80 [degrees]. I've got it back to 78 [degrees]. I am back at the setting of almost 7.5 on the suit set selector. I'm going to setting number 8 at this time. |
| 01 58 43 | CC | Understand. You are going to number 8 on suit setting. |
| 01 58 47 | P | That is correct. |
| 01 58 50 | CC | Would you say again your suit temperature. |
| 01 58 52 | P | Suit temperature at this time is dropping slowly. It is now 77 [degrees]. |
| 01 58 59 | CC | You're rising? |
| 01 59 01 | P | Negative. It is dropping—lowering. |
| 01 59 03 | CC | What is your dome temperature? |
| 01 59 06 | P | It is coming down. It is now 81, 81 [degrees]. |
| 01 59 10 | CC | Roger. I copied. |
| 01 59 11 | P | Okay, I think we got locks on it by going higher in settings. |
| 01 59 17 | CC | Say again. You were garbled. |
| 01 59 19 | P | I think we have the situation under control. |
| 01 59 28 | P | I am now in ASCS, gyros normal, manuver off, all systems green. I am green. |
| 01 59 35 | CC | Roger. Understand. Auto retro. |
| 01 59 39 | P | That is affirmative. |
| 01 59 46 | CC | Ous telemetry shows pitch attitude of 25 [degrees] negative and our scanner shows 36 [degrees] negative. |
| 01 59 59 | P | Roger. Your scanner is correct. I am indicating 36 [degrees]. Negative that it checks with the window. |
| 02 00 11 | CC | Sigma Seven. |

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|---|---|---|
| 02 00 13 | P | Go ahead. Go ahead. |
| 02 00 17 | CC | Stand by for a [contingency recovery area] 2 Charlie retro time. |
| 02 00 25 | CC | Sigma Seven. Kano Cap Com. |
| 02 00 27 | P | Go ahead. I'm ready to copy. |
| 02 00 34 | CC | Sigma Seven, do you read? |
| 02 00 36 | P | I read. Go ahead, Kano, |
| 02 00 40 | CC | Sigma Seven. |
| 02 00 43 | P | Kano, this is Sigma Seven. Go ahead. |
| 02 00 47 | CC | This Kano Cap Com transmitting in the blind, Sigma Seven. 2 Charlie time is 02 04 30. |
| 02 01 03 | P | This is Sigma Seven. Roger. 02 04 30, for 2 Charlie. |
| 02 01 16 | CC | Sigma Seven, come in please. |
| 02 01 19 | P | This is Sigma Seven, I read you loud and clear. How me? |
| 02 01 22 | CC | I read you now. Did you get my 2 Charlie time? |
| 02 01 26 | P | Roger. 02 04 30. |
| 02 01 32 | CC | Would you say it back to me. |
| 02 01 34 | P | Roger. 02 04 30. |
| 02 01 41 | CC | That is Roger. |
| 02 01 47 | CC | How is your suit temperature now, Seven? |
| 02 01 52 | P | It is now coming down to about 76 [degrees] and the dome is 80 [degrees]. We're going in the right direction. |
| 02 02 00 | CC | Is your cabin temperature holding? |
| 02 02 04 | P | Cabin temperature is under control. It is 95 [degrees]. 95. |
| 02 02 11 | CC | Roger. |
| 02 02 17 | CC | How do you feel? |
| 02 02 20 | P | I feel very comfortable now. I'm cooling off at last. |
| 02 02 24 | CC | Very good. |
| 02 02 26 | P | I am going to manual proportional at this time. |
| 02 02 31 | CC | Are you going to power down? |
| 02 02 32 | P | Negative. This is manual proportional. |
| 02 02 34 | CC | Roger, understand. |
| 02 02 41 | CC | T/M LOS, Seven: |
| 02 02 46 | P | Roger. |
| 02 02 54 | CC | Seven, do you read? |
| 02 02 57 | P | This is Sigma Seven. I read you still. |
| 02 03 00 | CC | I read you very clear, Wally. |
| 02 03 02 | P | Roger. |
| 02 03 12 | P | Gyros are free. |

## ZANZIBAR (SECOND PASS)

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|---|---|---|
| 02 04 53 | CT | Sigma Seven, Sigma Seven, Zanzibar Com Tech transmitting HF/UHF. How do you read? Over. |
| 02 04 59 | P | Sigma Seven on HF. Read you loud and clear. How me? |
| 02 05 21 | P | Zanzibar, Sigma Seven. Over. |
| 02 05 25 | CC | Sigma Seven, Sigma Seven, this is Zanzibar. I am not reading your signal. What are you transmitting on, please? |
| 02 05 34 | P | Sigma Seven on HF. |
| 02 05 41 | CC | Sigma Seven, Sigma Seven, this is Zanzibar Cap Com. Do you read? Over. |
| 02 05 51 | CC | Sigma Seven, Sigma Seven, this is Zanzibar Cap Com. Do you read? Over. |
| 02 05 55 | P | Zanzibar, this is Sigma Seven. I read you loud and clear. How me? Over. |
| 02 05 58 | CC | Roger. I'm not reading you. I'm not reading you. Very, very weak. Will you report the suit control setting now, and how do you feel? |
| 02 06 12 | P | This is Sigma Seven. I feel marvelous and I have finally knocked suit control. |
| 02 06 35 | P | This is Sigma Seven. I had a slight case of double authority here. I got very bored with manual proportional during the drifting period and forgot to put the rate command switch to auto, . . . it's about one stroke in pitch. |
| 02 06 52 | P | Zanzibar, this is Sigma Seven. Over. |
| 02 07 01 | P | Zanzibar Cap Com, Sigma Seven. Over. |
| 02 07 19 | P | Zanzibar Cap Com, Sigma Seven. Over. |
| 02 07 30 | CC | Sigma Seven, this is Zanzibar. Over. |
| 02 07 41 | CC | Sigma Seven, Sigma Seven, this is Zanzibar. Over. |
| 02 08 53 | P | Zanzibar Cap Com, Sigma Seven on UHF. Over. |

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|---|---|---|
| 02 09 57 | P | Indian Ocean Ship, Indian Ocean Ship, Sigma Seven. Over. |
| 02 10 45 | P | Indian Ocean Ship, Indian Ocean Ship, Sigma Seven on UHF-high. Over. |
| 02 11 11 | P | Indian Ocean Ship, Indian Ocean Ship, Sigma Seven. Over. |
| 02 12 04 | CC | Sigma Seven. |
| 02 12 09 | P | Indian Ocean Ship, Indian Ocean Ship. This is Sigma Seven. I read you. How do you read me? Over. |
| 02 12 15 | CC | Read you now. Do you have anything at this time? Over. |
| 02 12 18 | P | Roger. I have good news. The suit dome temperature is now 70 degrees. The suit inlet temperature is now 70 degrees. Over. |
| 02 12 51 | CC | Sigma Seven, Sigma Seven. Surgeon wants to know if you feel particularly hot. |
| 02 12 57 | P | No, I feel very comfortable. Did you read what I've got for the suit temperature? |
| 02 13 04 | CC | Roger. Understand. |
| 02 13 18 | CC | Sigma Seven, this is IOS Cap Com standing by. Over. |
| 02 13 22 | P | Roger. I want you to read back what temperatures I gave you on the suit dome and on the suit inlet. Over. |
| 02 13 30 | CC | Roger. The suit temperature is 70 [degrees]. The suit inlet temperature is 70. Over. |
| 02 13 38 | P | Roger. The dome is now about 63 degrees and is holding fairly steady. I will monitor it so it doesn't go too low. |
| 02 13 50 | CC | Roger, 63 [degrees], dome, holding steady. Over. |
| 02 13 54 | P | Roger. I think we've got that problem licked. |
| 02 14 47 | CC | Sigma Seven, I have about 1 minute to LOS. Over. |
| 02 14 54 | P | Roger. Everything is good here. Thank you very much for waiting for me to come by again. |
| 02 16 32 | P | IOS, this is Sigma Seven. I'm not sure whether you realize but I have been in auto mode retroattitude. Over. |
| 02 16 58 | P | At last we have solved the suit circuit temperature problem. I can see why Scott was concerned about this record position only. There is no side tone as well. The suit temperature at this time is—c.e.t. 2 17 20 MARK. [2 17 20]T—is 68 degrees and I'm feeling marvelous. The suit dome is about 72 degrees again. Apparently, it does fluctuate, and we are going into the night side at this time. I believe we have the suit circuit under good control. I will go back to VOX push-to-talk. Standing by for Muchea at 25 [minutes]. Gotta watch one sunset. |
| 02 17 55 | P | Sunset is rather striking. I don't think that I need to waste much time looking at them. They are very interesting. The other thing, it's fascinating is how black it is when your eyes are not adapted. I definitely can see some coating on the window. Going back to VOX at this point in UHF-high to transmit. Opening visor to wipe off the right microphone. I licked it. Closing visor. Visor was sealed immediately for the suit circuit to go to work for me. I don't want to get fouled up with it again. The suit inlet is holding very nicely at about 68 [degrees]. So the dome again is going to go back up. It's now up at 76, 75 [degrees]. Apparently this higher setting is the one we want. Think I'll put in another half a mark on that now and we may have her locked. She's getting kinda cool at last so I know where I want to go with the setting. I have set the coolant quantity for the suit and control lever at 8.5 at 2 hours 19 minutes 28 seconds. The readout the dome at this time is 75 [degrees]. The suit inlet is 68 [degrees]. Very pleasant. I can feel cool air crossing my face. The oxygen quantity looks real good, 60 and 75 [psi, in hundreds]. I have been watching the 250 inverter. It is approaching 140 degrees, and the 150 contrast is down to about 100 degrees. Standby is about 100 [degrees] which is cabin temperature. Thirdly, the 250—that one's suffering, and I will keep an eye on it. Cabin heat exchanger is definitely settling out at 40 degrees, and its given me a hard time because I obviously owe Frank Samonski 50 cents. I'm pleasantly surprised. Cabin fuel too, is reading a little high. Let me see now, we're carrying 5.5 psia, it's reading about 5 point, correction, 5.3, that's not too high for this cabin. It's getting nice and dark out, I think I'll take a peek out at the stars at this point. The cover for the battery for the flashlight on the left glove is coming loose. Only where—where the switch is, is no problem, just a case of wearing out before they should. Drifting, checking my wrist watch as a backup and I have 2 hours and 51 minutes. Correction, that's 2 hours and 21 minutes. Check that, 2 hours and 21 minutes and 35 seconds. Right on. We're not too bad, we better get a c.e.t. check at Muchea on this trip. |

| | | |
|---|---|---|
| 02 22 25 | P | Going for the computer. Clock is reading about 2 hours and 23 minutes. We'll say 2 24. At 2 24 we should pick up Muchea, also pick up a yaw check. 2 24 we have 05 36 on the other set. |
| 02 23 13 | P | Perth should be coming into view and it should be—oh, what a beautiful yaw check this is, and it's approximately 10 degrees left of path. Better make that about 12 degrees left to path. Just on the edge of the window, and that should give us 0 [degrees] yaw. I cannot see anything through the periscope that would help me. It is too—it is too cloudy. I'm coming out on VOX 1, 2, 1, 2. VOX is now coming in very well. |

## MUCHEA (SECOND PASS)

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| 02 24 03 | CC | Sigma Seven, Sigma Seven, this is Muchea Cap Com. How do you read? Over. |
| 02 24 07 | P | Muchea, this is Sigma Seven. Read you loud and clear. How me? |
| 02 24 11 | CC | Read you loud and clear also, Wally. How about a standard report? |
| 02 24 15 | P | Okay, Gene. I'll give you the suit thing first so everybody is off the hook. We have a dome on the suit of 72; that is, dome temperature [degrees]. I have a suit inlet of 66 [degrees] on the suit and the suit setting is 8 and I am very happy with the suit circuit at this time. I am very comfortable. |
| 02 24 43 | CC | Roger. Cape advises they are very happy with the whole situation at this time. Particularly, the ECS systems solved itself, and they seem to think you have a good handle on the whole situation there. |
| 02 24 55 | P | Roger. I lost it for a while when I went back to the 3 setting, but I didn't stay there very long. It definitely should be about 7½ to 8. At this point, I am on ASCS auto retroattitude. I am going to go to fly-by-wire shortly. I had been on gyros normal, and maneuver has been off. All systems are green. I snapped off about 2 percent of manual [fuel] one time by hitting RSCS. It was double authority. It was my boo-boo. It was just one pitch down motion. |
| 02 25 34 | CC | Roger. Understand and stand by. |
| 02 25 37 | P | Okay. I would like to go ahead with my night yaw check on fly-by-wire low. |
| 02 25 42 | CC | Roger. We'll stand by. |
| 02 25 44 | P | Okay. Now I'm using the moon which is to the left of me, and it's a real good fix for it. I'm just gonna go ahead and cover up the attitude indicator and you can watch the yaw. I'm going to gyros free, trying to select to fly-by-wire low at this time. I'm gonna put the moon in the center of the window first—and holding roll and pitch and then put the moon back where it belongs. The Moon is approaching the center of the window at this point. Okay. I'm gonna stop it there, and we'll put the roll control in to get that balanced out. Okay. At this point, I will get 0 roll. I have overshot the Moon and am picking up the planet Mercury which is nice and bright, and that's a little bit far to the right. Now take a check off and we'll see how many degrees we've got here in yaw. About 20, which is enough for a quantitative check. We'll bring her back now. And I have to go ahead with slight roll motion each time I do this. This is to track the horizon naturally. |
| 02 27 06 | CC | Roger. Understand. |
| 02 27 11 | P | Okay. We're coming to the right as you may be able to see, and we're coming around very well. I still have to correct my roll out. Coming up on yaw attitude very shortly here. I'm quite satisfied with both day and night checks. I've been real pleased with it. I have to say this has been a real treat to see these bears flow into place. |
| 02 27 39 | CC | Roger. Everything checks out just as you say on the ground indication, Wally. |
| 02 27 44 | P | Okay. I'm gonna give you a mark on the moon now for a yaw reference. I would say this is now zero yaw. MARK. [02 27 51]$^T$. |
| 02 27 56 | CC | Fine. We had a −4 on the ground. That's pretty good. |
| 02 27 59 | P | −4. Okay, I'll check here. Looks about right. I could have come right a little bit more. Okay. That's about all I need for the night yaw checks, and, as far as I'm concerned, I'll go back and give the guys some more ASCS time. I don't see any reason to burn up too much fuel. Now I'll give one you one of those things for your Sir John. |
| 02 28 26 | CC | Roger. Understand. There's a few lights on at . . . . Can you see anything? |
| 02 28 33 | S | We seem to be getting reasonable body temperatures now, Wal. |
| 02 28 36 | P | Oh, very good. Warren, nice to hear from you, old man. |
| 02 28 40 | S | Me too. How are you, Sand Groper? |
| 02 28 41 | P | Oh, great sport. Understand some suds are on the way back. |
| 02 28 50 | P | I might as well look down and see if you fellows have got some lights on. I'm gonna kill the blood pressure. |

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|---|---|---|
| 02 28 55 | CC | Shannon runs out of fuel, . . . he doesn't get bogged down in the sand. |
| 02 28 59 | P | Ha! Ha! I still have black skid marks on my swim fins from your trip into the bush. Okay, you can see I've yawed right again. I need to come—correction, yawed left. I need to come right, the moon is right on the horizon. I'll put it right on again, just to show you how easy it is to acquire. I seem to be holding up on my fuel minimum so I'll go ahead and play with it a little bit here. Okay, we're just about on in yaw, and still off in roll. I'll slap her in and we'll have it made. Here comes roll to straighten her up. Coming up on roll—. Okay, I'm quitting right there. That's about as good as I'll ever give you. Little off in roll here. There we go. Now, that's what I would give your Okay, I'm gonna go back to gyros normal, and let them come back on the line. I'm going to set up now and uncover the instruments for chimpanzee configurations. Dammit, I'm sorry, auto mode. |
| 02 30 13 | CC | Roger. I understand. |
| 02 30 15 | P | I broke my promise. |
| 02 30 22 | CC | We had you on a +5 [degree] roll when you uncovered. |
| 02 30 26 | P | Right. That's about right. Oh! I've got some lights down there. How about that? |
| 02 30 33 | CC | Good, that's us. |
| 02 30 34 | P | That's a great deal. Sure thank you all. I've got a washer in here. I captured a washer and a little piece of metal and this looks like sort of a conical washer like a Voishan type or something. Better not be. |
| 02 30 50 | CC | Fine—. Can you give us another blood pressure? That one cut off a little too soon. |
| 02 30 54 | P | Okay, let me get back into configuration here. I'm going to ASCS at this time. And she walked in without any high thrusters, I believe. Will you double check that? And for that, I'll give you a blood pressure. |
| 02 31 09 | CC | Roger. |
| 02 31 11 | P | Got to check the Sanborn, I guess, for that one. Coming up on BPMS. Gene, I'm real pleased with the suit temperature now. I've got a real steady 65 [degrees]. Although the dome is reading just about 70 [degrees] as a steady number. |
| 02 31 37 | CC | Roger. 65 and dome 70. |
| 02 31 39 | P | Right. The cabin is just sitting here fat, dumb, and happy. I haven't had to do a thing to it. Now, have you been watching my 250 inverter? |
| 02 31 54 | CC | I've got 55 [degrees] on the ground. |
| 02 31 57 | P | I've got 140 [degrees] here. And the trend has been very slow building up. I don't think I'll change the cold plate settings. The 150 is holding about . . . . |
| 02 32 08 | CC | This is Muchea—recommend you go over to Woomera. |

## WOOMERA (SECOND PASS)

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| 02 32 10 | P | Roger. Woomera Cap Com, Sigma Seven. Over. |
| 02 32 15 | CC | Sigma Seven, Woomera Cap Com. Loud and clear. Over. |
| 02 32 18 | P | Roger. Nice to be back over Woomera. |
| 02 32 21 | CC | Same here. And. . . . |
| 02 32 22 | P | I'm a little bit. . . . |
| 02 32 23 | CC | . . . mode. |
| 02 32 24 | P | Okay. |
| 02 32 25 | CC | . . . condition. |
| 02 32 26 | P | Roger. I am in ASCS auto, in other words a normal mode. Gyros are normal, maneuver is off, all systems are green. I'm real happy with the suit circuit at this time. |
| 02 32 41 | CC | Roger. We received your last reports from Muchea, and is that auto retro? |
| 02 32 46 | P | That is auto retro. Would you give me a time hack at 33 minutes. Over. That's 2 hours, 33 minutes. |
| 02 33 06 | CC | You want to get your blood pressure stopped? |
| 02 33 08 | P | Roger. Can you read me? |
| 02 33 10 | CC | Affirmative, we are reading you. |
| 02 33 12 | P | I need a mark on capsule elapsed time. Your ground elapsed time, give it to me at 30 seconds. |
| 02 33 20 | CC | Roger. |
| 02 33 26 | CC | 5, 4, 3, 2, 1. MARK 02 33 30. [02 33 30] T. |
| 02 33 34 | P | Roger. I read 31. I'm 1 second fast. That's very good. |
| 02 33 39 | CC | Your T/M readout on your capsule elapsed time occasionally reads out 1 second fast and then comes out to be correct with our time, then it gains a second again. |

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|---|---|---|
| 02 33 50 | P | Welcome to the Quiver club. |
| 02 33 52 | CC | Roger. |
| 02 33 55 | P | Okay. I think I gave you some good old blood for that one. Thanks for the swap. |
| 02 34 02 | S | Roger. That was the stop button. The stop button, we're still getting it. |
| 02 34 07 | P | Okay, I'll stop her. |
| 02 34 09 | S | Roger. |
| 02 34 10 | P | I'll try to give you the full bit. |
| 02 34 13 | S | Thanks. |
| 02 34 14 | P | You were so nice asking for it. I had to give it to you. |
| 02–34–17 | S | We meant the stop button. |
| 02 34 20 | P | Oh, for gosh sakes, I gave you a whole new one. |
| 02 34 23 | S | Ha! Ha! It never quit. |
| 02 34 25 | P | I see. |
| 02 34 26 | S | Looks good now. |
| 02 34 27 | P | Good show. Okay, I feel happy about the fuel condition. We've got—I'm reading 95 [percent] auto, 90 [percent] manual. What are you reading? |
| 02 34 38 | CC | Reading 98 [percent] auto and manual 94 [percent]. |
| 02 34 46 | P | Well, how about that. |
| 02 34 48 | CC | Beautiful. |
| 02 34 50 | CC | Okay, Spacecraft Commander, this is Woomera Systems. Do you have any high thruster actions during your last pass over Woomera and Muchea? |
| 02 34 59 | P | I don't think so, because I was just cruising over you that time in fly-by-wire low and ASCS. I had one. . . . |
| 02 35 06 | CC | Z Cal jumped down here and indicated high thrust. We think that was probably erroneous. |
| 02 35 14 | P | I'm quite sure it was because I would have noted it rather rapidly. I made one large thrust application in the flight so far, where I was going back from manual proportional to fly-by-wire and I forgot to move the rate command switch to auto. I had one pitch function and you really know it. So if I had a high thruster, I'm sure I would have known it. |
| 02 35 37 | CC | Roger. |
| 02 35 38 | P | Very good. Thanks for looking out for me. |
| 02 35 43 | CC | Everything looks green down here. |
| 02 35 45 | P | Oh, it's great up here. |
| 02 35 47 | CC | Standing by. |
| 02 35 48 | P | Righto. I'm seeing a lot of your lightning now. |
| 02 35 53 | CC | Yeah, we got a bunch. |
| 02 35 54 | P | I'll bet you have. Sorry I couldn't see your flare just—I thought I saw, but it's just lightning all the time. |
| 02 36 03 | CC | Maybe next time. |
| 02 36 05 | P | Okay. I see Africa. Looks pretty good down there. We'll give them a whack at it. Don't give up though, I think the flare will help us some day. |
| 02 36 19 | CC | We'll let Gordo take a look at it. |
| 02 36 23 | P | Right. I'm gonna do a little star gazing now. |
| 02 36 29 | CC | Woomera has T/M LOS. |
| 02 36 30 | P | Roger, Woomera. |
| 02 36 34 | CC | Sigma Seven, Woomera. |
| 02 36 36 | P | Go ahead, Woomera. |
| 02 37 38 | P | There's the old Corona Australis, shows in beautifully, and we've got Nunki. We've got Kaus Australis, and Nunki is right on the flight path where it belongs. I'm reading 0 yaw, 5 degrees left roll, in retroattitude. I sure would like to know why it's so complicated. And up above those boys I should pick up another brighty. That must be, has to be Altair. Very good. You actually get the feeling that you aren't really going over Australia on this flight. Okay. Now let's see, we finished yaw check for those boys, coming up on Canton. They get more ASCS than they reckoned for this time. |
| 02 38 53 | P | That's right, on HF at 3 plus 20, everything else is in order. Take another look at that dome there, over there. Suit temperature is 64 [degrees] and I'm really happy. |

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| 02 39 20 | P | $T_r$–10 back to normal. I've done that earlier. Okay, we got—got suit pressure. Go ahead and take a look at the inverters again here. 250 is 141 [degrees], 150 is about 107 [degrees]. Well enough alone. Standby is . . . 7. Just about ambient. Negative, it's even a little. . . . The cabin pressure is about 5.3 [psia], which is perfect. Suit dome is 72 [degrees]. Cabin dome is 45 [degrees] and cabin is holding. Suit temperature is about 64 [degrees] and I like it. Oxygen is 60 [psi, in hundreds]. Cabin $O_2$ is 5.3 [psi], and a complete electrical. |
| 02 41 00 | P | All batteries are reading about 23½ [volts] or higher; ammeter is just about steady at 20 amps. Wanted to check before we power down, ASCS is 115 [volts]. Fans is about 115 [volts], standby 0 [volts]. Okay, the cockpit is clean. It's obvious that that damn antenna situation is no good. Just brought HF back in bicone again. |

## CANTON (SECOND PASS)

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|---|---|---|
| 02 42 06 | CT | Sigma Seven, Sigma Seven, this is Canton Com Tech. Over. |
| 02 42 12 | P | This is Sigma Seven. I read you loud and clear. How me? |
| 02 42 21 | P | Okay. We're back in dipole. |
| 02 42 23 | CT | Seven, Canton Com Tech, how do you copy? |
| 02 42 27 | P | Canton is coming in early. No, he's coming in about on time. |
| 02 42 34 | P | Canton Com Tech, this is Sigma Seven. Read you loud and clear. How me? |
| 02 42 39 | CT | Sigma Seven, Sigma Seven. This is Canton Com Tech, Canton Com Tech. How do you copy? Over. |
| 02 42 51 | P | Canton Com Tech, this is Sigma Seven. I read you loud and clear. How me? Over. |
| 02 43 02 | CT | Sigma Seven, Sigma Seven, this is Canton Com Tech, Canton Com Tech on HF. Over. |
| 02 43 10 | P | Canton Com Tech, this is Sigma Seven. How do you read me? Over. |
| 02 43 16 | CT | Sigma Seven, Sigma Seven, this is Canton Com Tech on HF/UHF. Over. |
| 02 43 30 | CT | Sigma Seven, Sigma Seven, this is Canton Com Tech, Canton Com Tech, how do you copy? Over. |
| 02 43 38 | P | Canton Com Tech, this is Sigma Seven. I read you loud and clear. How me? |
| 02 43 46 | CT | Sigma Seven, Canton Com Tech. I read you 5 by. Over to Cap Com. Over. |
| 02 43 52 | P | Roger. I'm here too. |
| 02 43 57 | CC | Sigma Seven, this is Canton Cap Com. Over. |
| 02 44 00 | P | Roger, Canton. All right, I'll give you a short report. I am in auto retro mode, gyros normal, maneuver off, all systems are green, suit circuit is under positive control. |
| 02 44 26 | CC | Roger. Can—Roger, Sigma Seven. |
| 02 44 30 | P | This is Sigma Seven. I am ready at this time for a retrosequence if required. All I have out is one star chart and that's it. |
| 02 44 43 | CC | Roger, Sigma Seven. |
| 02 44 45 | P | And you'd better not give me one. Ha, Ha, Ha. |
| 02 44 50 | CC | Say again, Sigma Seven. |
| 02 44 51 | P | I don't want one. Ha, Ha. |
| 02 44 53 | CC | Roger. |
| 02 44 55 | P | She is really performing like a jewel right now. |
| 02 45 03 | CC | Say again, Sigma Seven. |
| 02 45 05 | P | I said she is performing like a little jewel. |
| 02 45 08 | CC | Roger. That's great. |
| 02 45 10 | P | Now, the only thing we had trouble with so far is the suit circuit, and we've got that pretty well licked. |
| 02 45 17 | CC | That's what I understand from listening over the Goddard conference [network communications loop]. |
| 02 45 20 | P | Now, just for your briefing, I've got a suit inlet [temperature] now of about 63 degrees, and the dome is holding steady, at 70 degrees. |
| 02 45 33 | CC | Roger. Understand. |
| 02 45 34 | P | I'm perfectly comfortable. I'm gonna quit with that thing while I'm ahead. |
| 02 45 39 | CC | Roger. |
| 02 45 44 | P | Some of that reason that I've lost HF communications, I believe, is that I keep bumping that switch from dipole to bicone. You understand? |
| 02 45 54 | CC | You say you keep bumping the switch from dipole to bicone? |
| 02 45 59 | P | That is correct. So on the HF check here, I'm set up for it. I think we can probably get a good one this time. |
| 02 46 06 | CC | Roger. |

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| 02 46 07 | P | That's at 3 hours and 20 minutes, of course. Apparently I've got to keep checking that thing for bicone. Correction—for dipole. |
| 02 46 17 | CC | Roger. Understand. |
| 02 46 20 | P | I just have to move my elbow to the right, and I knock it. |
| 02 46 24 | CC | I see. |
| 02 46 28 | P | It's not critical. It's just a way of doing business. I had compared the night yaw checks over Muchea and Woomera, and am very satisfied with the results. With known objects it is absolutely no problem at all to acquire yaw. In addition, we can watch . . . down through the window. |
| 02 46 47 | CC | Roger. That's what I heard. I heard your report at Woomera. |
| 02 46 53 | P | Roger. There is nothing new up here then. |
| 02 47 02 | CC | Roger. We have nothing. No questions here. |
| 02 47 06 | P | Roger. Apparently, the 250 inverter is not going up very much. My reading is still remaining about 140 degrees. |
| 02 47 19 | CC | Roger. |
| 02 47 33 | P | I guess Frank Samonski knows I owe him a half a dollar by now. |
| 02 47 38 | CC | Roger. |
| 02 47 53 | P | For your information, because you can't read it, my retro [package] temperature at this time is 72 degrees. |
| 02 48 01 | CC | Roger. Understand 72 degrees. |
| 02 48 05 | P | That is correct. |
| 02 48 06 | CC | Thank you. 72 degrees. |
| 02 48 09 | P | Seventy-two degrees for the retro heater. Retro-rocket, rather. There are no heaters. |
| 02 48 49 | P | I'm opening the visor just for a moment to scratch my nose. |
| 02 48 55 | CC | Roger. |
| 02 48 56 | P | And closing visor. I missed on that; I'm gonna have to reseal that. Okay, it's resealed. I'd just as soon not stay on that cabin any longer than necessary. |
| 02 49 12 | CC | Roger. |

## HAWAII (SECOND PASS)

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| 02 49 35 | CT | Sigma Seven, Hawaii Com Tech. How do you read? Over. |
| 02 48 38 | P | Hello, Hawaii Com Tech. I read you loud and clear. How me? |
| 02 49 46 | P | Hawaii Com Tech. This is Sigma Seven, read you loud and clear. How me? Over. |
| 02 49 50 | CC | Sigma Seven, Hawaii Cap Com. |
| 02 49 52 | P | Hi, Gussie, how ya' doin'? |
| 02 49 56 | CT | Sigma Seven, Hawaii Com Tech. |
| 02 49 59 | P | Hawaii Com Tech, Hawaii Cap Com, this is Sigma Seven. I read you loud and clear. How me? |
| 02 50 04 | CC | Sigma Seven, this is Hawaii Cap Com. How do you read? |
| 02 50 09 | P | I read you loud and clear. |
| 02 50 15 | P | Hawaii Cap Com, I will start a standard report for you. I am in auto retroattitude. I have gyros normal, maneuver off, all systems are green, and go for the next orbit. Over. |
| 02 50 37 | CC | Roger, Wally. Understand all systems are green and go. We indicate you have a go down here. |
| 02 50 44 | P | Roger. |
| 02 50 45 | CC | Could you give me a c.e.t., please? |
| 02 50 47 | P | Roger. Stand by for a mark at 50. MARK 50. [02 50 50]T. That's 2 hours 50 minutes plus 50 seconds. |
| 02 50 52 | CC | Roger. We indicate you're 1 second fast. |
| 02 50 56 | P | Roger, Gus. I think everybody's got the reading on the suit circuit; I won't bother bringing that up any more. |
| 02 50 59 | CC | Roger. I'd like to have a cabin temperature and a cabin dome temperature. |
| 02 51 04 | P | Okay. Cabin temperature is 97 [degrees]. The dome is 45 [degrees]. |
| 02 51 08 | CC | Say again dome temperature. |
| 02 51 17 | P | 45. |
| 02 51 20 | CC | Roger. 45. |
| 02 51 22 | P | And the setting has not been changed for a long time. |
| 02 51 26 | CC | Roger. |
| 02 51 27 | P | I have not changed the setting on the inverters. I'll give you a recap on those. Inverters are at 4. That's the [coolant control] valve setting. The cabin is at 3. The suit is at 8. |
| 02 51 43 | CC | Roger. |
| 02 51 45 | P | And it's working all very fine. I've got about 62 [degrees] inlet now on the suit. |

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| 02 51 52 | CC | Would you push your blood presssure stop button, Wally? |
| 02 51 56 | P | Roger. |
| 02 52 01 | P | Now you don't have to ask me for it, you have to tell me to stop. This is horrible. Ha! |
| 02 52 06 | CC | I'd rather ask you to give it. |
| 02 52 08 | P | I liked your dispatch the other day. It helped. |
| 02 52 14 | CC | I almost forgot. Aloha, from Hawaii. |
| 02 52 16 | P | Oh! Aloha. |
| 02 52 24 | P | Got some real good night yaw checks, Gus. It just slops right in. |
| 02 52 28 | CC | Roger. |
| 02 52 29 | P | And, your reports on manual proportional, just about right. The tail-off is what you see more than anything else. It's a little sluggish. |
| 02 52 51 | CC | Wally, Cape seems to think you're in good shape also. |
| 02 52 53 | P | Roger. I feel fine. This old bird is really performing up here. |
| 02 52 59 | CC | Good show. |
| 02 53 25 | CC | Wally, give me a reading on your attitudes now. |
| 02 53 29 | P | Okay, I am rolled left about 7 degrees. Yaw right, 2 degrees. Pitched up about 4 degrees. |
| 02 53 41 | CC | Roger. Pitch up, 4 degrees. |
| 02 53 43 | P | That's affirmative. |
| 02 53 45 | CC | Roger. |
| 02 53 46 | P | We have a $\pm 5\frac{1}{2}$-degree envelope on this one, Gus. |
| 02 53 51 | CC | Roger. |
| 02 53 59 | P | She's tracking beautifully. I haven't had a thruster one problem. Really nice. |
| 02 54 05 | CC | Roger. Give me your pitch attitude again, Wally. We don't agree with that. |
| 02 54 09 | P | Okay, I have an indicated [—] 30 degree pitch, and it checks with the window just about right on the button, Gus. |
| 02 54 18 | CC | Okay, Roger. I misread you then. |
| 02 54 21 | P | I'm sorry I said +4. I was going up from the retro mark which would probably confuse you. |
| 02 54 29 | CC | Yes, you did. |
| 02 54 30 | P | I can imagine. |
| 02 54 31 | P | Okay, I'll read them out the way I see them instead of the way the SEDR [Service Engineering Department Report] boys do it. I'm getting the old fireflies again. I guess John is relieved. I haven't been looking for them—they're just there. |
| 02 54 49 | CC | Okay. |
| 02 54 52 | P | They're just freebees. You can see some big ones and some little ones. They're almost impossible to photograph. Most of them are of a less magnitude than I'd say a good star. Every once in a while you see some of the big ones. |
| 02 55 08 | CC | Do you see them close to you? |
| 02 55 11 | P | Oh, yeah, you can actually see relative motion, Gus. You can see them right by the window, then have them drifting way away. Looks like you see them way out because the velocity between you and fireflies is definite. |
| 02 55 27 | CC | Roger. Wally, I think we're losing you. Will you stand by for California? |
| 02 55 31 | P | Okay, Gus. I want to talk about this to John. He's the one that's been waiting. I guess we're gonna have them all the time. |
| 02 57 54 | P | Sunrise over the West Coast. It is rather disappointing because it is just about socked in completely; smog and cloud conditions. I am seeing breaks as I approach the coast line. Someday, I'll get a flight across the Pacific without clouds underneath me. |
| 02 58 26 | P | The attitudes check out very well. No doubt about it. Yaw can be seen with the periscope. And it can be acquired very rapidly. It can also be seen through the window without any device. |
| 02 59 05 | P | Covering up the periscope again. Standing by for John. |

## CALIFORNIA (SECOND PASS)

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|---|---|---|
| 02 59 10 | CC | Hello Sigma Seven, Cal Cap Com. Do you receive? Over. |
| 02 59 12 | P | Hi there, John. I read you loud and clear. How me? |
| 02 59 16 | CC | Hello Sigma Seven, Cal Cap Com. Do you read? |
| 02 59 19 | P | Cal Cap Com, Sigma Seven. Loud and clear. How me? |
| 02 59 22 | CC | Roger. Loud and clear, Wally. Looks like things are leveling off pretty good up there. Looks like it's going fine now. You got a status report? |

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| 02 59 28 | P | Yes sir. I'm real happy with this bird. I am in ASCS auto mode, retro attitude, I have gyros normal, maneuver off, all systems are green. I've got the suit circuit under control as you probably know by now, and a delightful report for one John Glenn. I do see fireflies. |
| 02 59 52 | CC | Good boy. |
| 02 59 54 | P | And they were your color, John. That was a very good description. Although during the bright side, if I rap them, they're definitely white. While on the sun center sunrise, they come out the true firefly color you described. |
| 03 00 16 | P | John, did you read all that? |
| 03 00 18 | CC | This is Cal. Now reading you very weak, Wally. You faded after that first good transmission there. I got that you were seeing the fireflies and then you faded out on your description. Repeat please. |
| 03 00 29 | P | Okay. How do you read me now? |
| 03 00 31 | CC | Loud and clear again. |
| 03 00 32 | P | Okay, we're back on UHF-high. They were definitely the fireflies that you described at sunrise. I haven't been looking at sunsets particularly. As we get brighter, for example, now when I'm in the daylight and I rap it, I get white crystals which look like ice. |
| 03 00 53 | CC | Roger. Got that all okay. Understand as described at first, and they got whiter as you into better light. |
| 03 00 59 | P | Right. I've got white ones right now that are sort of drifting around. Look like little bits of frost. |
| 03 01 05 | CC | Roger. Sounds good. Are you read to copy [recovery area] 4–1 retrosequence? Over. |
| 03 01 11 | P | Roger. Go ahead, John. |
| 03 01 13 | CC | Roger. Incidentally, you have a go for the next orbit in case you were wondering. Cape concurs with that one. Your retrosequence time for 4–1 is 04 32 36. Over. |
| 03 01 25 | P | 32 36. |
| 03 01 26 | CC | Roger. 04 32 36. And Cape advises just proceed with normal flight plan. Looks like things are going fine. |
| 03 01 33 | P | Yeah, I feel real happy with everything. I stopped everything to get a hold of that suit circuit and that seemed to fix it up. |
| 03 01 40 | CC | Roger. That had everybody concerned for a while, but looks like it is in good shape now. |
| 03 01 44 | P | I was sure everybody was jumping up and down on that one. |
| 03 01 46 | CC | You were right. |
| 03 02 09 | P | It's kind of hard to describe all this, isn't it, John? |
| 03 02 12 | CC | Yeah, it sure is, Wally. Can't describe it. |
| 03 02 16 | P | No,—real, real thrill. |
| 03 02 20 | P | Too bad you're all socked in. I hope to see you pretty soon though. |
| 03 02 24 | CC | Haven't even looked outside. |
| 03 02 25 | P | Ha, ha, ha. That was my problem when you were going over. |
| 03 02 32 | P | I guess you heard my yaw reticle is working out very well. |
| 03 02 36 | CC | Yeah, that's real good. Glad to hear it. |
| 03 02 54 | P | I definitely did detect some fogging on the window from the tower rocket, John. |
| 03 03 00 | CC | Roger. Got that. Some fogging on the window from the rocket. |
| 03 03 04 | P | Yeah. |
| 03 03 12 | P | I'm gonna try your idea on pitch technique here for drifting. I think that'll be fun. |
| 03 03 18 | CC | Say again, Wally. Didn't get it. |
| 03 03 19 | P | I'll try your technique on the drifting period for this orbit by using—I think that will be a lot of fun. I just had a hole out here with an island. Looks like that might have been San Clemente, I'm not sure. Yeah, I'm over land now. |
| 03 03 39 | CC | Roger. |
| 03 03 40 | P | I'm getting a good sight of the U.S.A. We just got the typical California fog belt behind me and looks like I'm getting a watch at the Salton Sea, I believe. |
| 03 03 53 | CC | Roger. That's where Scott and I both picked up loud and clear over here. Seems to be always clear back in there. |
| 03 03 59 | P | Yeah, just as soon as you get over the ridge line. |
| 03 04 03 | P | I don't see anybody water skiing today. Is it cold? |
| 03 04 08 | CC | Not that cold. |
| 03 04 10 | P | Ha, ha, ha. |
| 03 04 44 | P | That's about as far north as I can see is the Salton Sea. You get a real good look at Baja California. And I probably can see Guaymas loud and clear, the way it seems. |

| | | |
|---|---|---|
| 03 04 56 | CC | Looks like you have pretty good visibility today, if you see all that area. |
| 03 05 00 | P | Yeah. I can see just about as far as the Salton Sea north. I can see the Mt. Whitney area, but not much of it for the snow-capped peaks that are just about on the horizon now. |
| 03 05 15 | CC | Right. |
| 03 05 16 | P | And I can see with a little craning, around almost the southern tip of the Baja peninsula. |
| 03 05 25 | CC | Sounds like you've got a real good view today with not much cloud cover up there over a lot of it. |
| 03 05 30 | P | No, just the coast is all that's socked in. The rest of it's CAVU [clear and visibility unlimited]. As long as I get some ASCS time I can look. I've got some roads down here that are pretty obvious to me right on the flight path. I'm really talking to you for a long way, John. |
| 03 05 58 | P | Cape Cap Com, Sigma Seven. |
| 03 06 16 | P | Cape Cap Com, Sigma Seven. |

## GUAYMAS (SECOND PASS)

| | | |
|---|---|---|
| 03 06 22 | P | Muchea Com, correction—Guaymas, Sigma Seven. |
| 03 06 26 | CC | Roger. Go ahead, Sigma Seven. |
| 03 06 28 | P | Okay, Scott. Things are going real well up here. Gonna get a grip on that coolant system, and your comment was very valid. If a guy has time, he can usually work it out. |
| 03 06 41 | CC | Roger. Wally, you faded out at the last. Understand everything is good up there; you have another good trip. |
| 03 06 48 | P | Right. I think I had a good look at your station going over. |
| 03 06 51 | CC | Roger. Understand. |

| | | |
|---|---|---|
| 03 07 10 | P | Cape Cap Com, Sigma Seven. Over. |
| 03 07 21 | CC | Sigma Seven, Sigma Seven. Cape Cap Com. |
| 03 07 24 | P | Roger, Deke. I'm on push-to-talk at this time. How do you read? Over. |
| 03 07 29 | CC | Roger. Reading you 5 by. |
| 03 07 30 | P | Roger. This is UHF-high. |
| 03 07 33 | CC | Roger. |
| 03 07 34 | P | Going to VOX. |
| 03 07 40 | P | Cape Cap Com. Sigma Seven. On VOX. |
| 03 07 42 | CC | Roger. You're good on VOX. |
| 03 07 44 | P | Okay. I'm sending you one. Control mode is ASCS; auto retro; gyros normal; maneuver off. All systems are green. I'll give you a readout on the domes here, if you'd like. |
| 03 08 11 | P | Cape Cap Com, Sigma Seven. |
| 03 08 13 | CC | Sigma Seven, Cape Cap Com. |
| 03 08 15 | P | Did you read the report? |
| 03 08 17 | CC | I read the report. Awaiting the dome temperature, particularly suit. |
| 03 08 20 | P | Okay. Suit dome is 70 [degrees]. Cabin dome is 45 [degrees]. That blasted cabin heat exchanger is 40 [degrees]. Suit inlet is 62 [degrees], and I'm very comfortable. |
| 03 08 38 | CC | Excellent. |
| 03 08 40 | P | Are you ready for me to make a power down yet? |
| 03 08 43 | CC | Very good. Would you give us all three inverter temperatures at your leisure. |
| 03 08 49 | P | Okay. I'll give you those, and then I'll power down. |
| 03 08 52 | CC | Roger. |
| 03 08 53 | P | 250 is 143 [degrees]. It's gone up about 2 degrees in the last 40 minutes. The 150 is about 105 [degrees]. The standby is about, ha, 110 [degrees] I'd say. A little warmer. |
| 03 09 12 | CC | Roger. |
| 03 09 13 | P | And the retro heaters, the retropackage temperature is about 74 [degrees], and it's stayed three almost all this time. |
| 03 09 21 | CC | Roger. That's very good. |
| 03 09 22 | P | Okay. I'm gonna go into a power down. |
| 03 09 25 | CC | Roger. Understand. |
| 03 09 26 | P | I'll give a readout on how I do it. Selecting fly-by-wire. Going to gyros caged. Judging gyros caged. I'm going to 0. |
| 03 09 44 | CC | Roger. |
| 03 09 45 | P | Going to ASCS bus, turning it off, and that's 0 volts. And am I clear to kill my beacon? |
| 03 09 56 | CC | Affirmative. |
| 03 09 57 | P | Okay. Beacon off. The rates are . . .. |
| 03 10 03 | CC | Hit your blood pressure stop button, we're still getting BP. |
| 03 10 06 | P | Yeah, instead of getting asked for it, I'm gotta asked to stop it now. |
| 03 10 11 | CC | That's a welcome changeover. |
| 03 10 13 | P | There go the beacons off. |
| 03 10 15 | CC | Roger. |
| 03 10 16 | P | I caught your Z Cal. Okay, the rates are nice and zeroing. I'm going back to normal position instead of fly-by-wire. |
| 03 10 28 | CC | Roger. |
| 03 10 29 | P | Gyros are caged, and the VOX is off. I'm going to select reentry for the attitude, so I got that set up for the powering-up procedure. |
| 03 10 38 | CC | Very good. |
| 03 10 40 | P | Okay. I've got fly-by-wire low, and the normal on the ASCS mode, auto, gyros caged, maneuver is still off. And the bea—and the beacons are off. Here she's cruising along very happily. |
| 03 11 01 | CC | Very good. Are you ready for a [contingency recovery area] 3–C retro [time]? |
| 03 11 03 | P | Say again. |
| 03 11 04 | CC | Are you ready for your 3–C retro time? |
| 03 11 08 | P | I'm sorry. You're very garbled. |
| 03 11 12 | CC | Are you ready for your 3 Charlie retro time? |
| 03 11 15 | P | Okay. I'll try to get it from you, Deke. I—you're garbled, say them very slowly. |
| 03 11 20 | CC | 03 39 36. |
| 03 11 26 | P | Okay. You came in loud and clear. |
| 03 11 28 | CC | All righty. |
| 03 11 29 | P | 03 39 36 for 3 Charlie. |
| 03 11 35 | CC | That's affirmative. |
| 03 11 36 | P | Okay. |

| | | |
|---|---|---|
| 03 11 39 | CC | Let me give you a G.m.t. time hack; see how we are there at this time. |
| 03 11 42 | P | Yeah. That's probably all fouled up. Okay. You give it to me. |
| 03 11 46 | CC | On my mark, I'm 15 27 00—MARK. (03 11 50)$^T$. |
| 03 11 52 | P | 27? |
| 03 11 54 | CC | Affirm. |
| 03 11 55 | P | Holy Malone! That's got a, okay, that thing is really a pile of gabog. I've got 24. |
| 03 12 05 | CC | . . . . |
| 03 12 07 | P | Well, let me try that G.m.t. on my backup clock here. Any time. |
| 03 12 15 | CC | Want a mark on the backup? |
| 03 12 17 | P | Yeah. |
| 03 12 19 | CC | Okay. 03 12 25 on my mark.—MARK. (03 12 26)$^T$. |
| 03 12 30 | P | That was 15 47 30. Is that correct? |
| 03 12 36 | CC | I gave you a mark on c.e.t., c.e.t. |
| 03 12 40 | P | Oh, oh, oh. I'm sorry, I was looking at my backup. |
| 03 12 43 | CC | Okay. |
| 03 12 45 | P | Let's try for c.e.t. again at 50 [seconds]. |
| 03 12 47 | CC | Roger, in 3 seconds. MARK. [03 12 51] $^T$. |
| 03 12 52 | P | Okay. I am a second and a half fast. |
| 03 12 53 | CC | Very good. |
| 03 12 55 | P | G.m.t.—of 28 coming up. Actually, I've passed it. |
| 03 13 01 | P | Give me 28 15. |
| 03 13 05 | CC | MARK. [03 13 05] $^T$. |
| 03 13 07 | P | Very good, I'm about 3 seconds slow on the backup. That's the best one. |
| 03 13 14 | CC | . . . . |
| 03 13 15 | P | Say again. |
| 03 13 17 | CC | Roger. Did you see Echo? |
| 03 13 19 | P | Negative. I could not get to it. I was trying to conserve some more fuel there, and couldn't get pitched up in the right attitude for it. |
| 03 13 27 | CC | Roger. How about Mercury? |
| 03 13 30 | P | Mercury? Loud and clear. I used Mercury and the moon for my night yaw check. |
| 03 13 37 | CC | Roger. |
| 03 13 38 | P | No, this thing has, ah, practically no rates indicated, Deke, but I'm now, I'd say rolled over, oh, probably 30 degrees to the left. Pretty close to pitch attitude, and of course it's pretty hard to tell what yaw is under these conditions. |
| 03 13 58 | CC | Roger. Eat and drink—you're also fading. |
| 03 14 04 | P | Okay. I think I'll try some of that. |
| 03 14 06 | CC | Roger. We'll leave you alone for awhile. |
| 03 14 09 | P | Okay. That might be fun, too. I'm now going to go ahead and do an orientation test. |
| 03 14 13 | CC | . . . . |
| 03 14 14 | P | Okay. Thank you. |
| 03 14 31 | P | Okay. On the orientation test. I touched the manual lever; I touched the clock, a rivet above the clock at about 10 30 just between the clock face and the yaw indicator. On the emergency rate lever, I touched it right on the button. |
| 03 14 53 | CC | You're coming in garbled. You must have your mouth full. |
| 03 14 55 | P | No. I'm just, ha ha, I'm talking about my orientation test. |
| 03 15 01 | CC | Roger. |
| 03 15 16 | P | Okay. We finally got the right scale for this. I've got to go to VOX record. Got the right scale for the dosimeter—and it is reading—about, less than 0.1, exactly 0.04. I am now putting the dosimeter back on the hatch—which is the lowest scale reading. |
| 03 16 00 | P | I'm back on VOX transmit now. Do you read, Deke? I've ended up with a beautiful 90 degree roll to the left. Boy, what a nice eight-point roll this is. Coming up for HF reception. Going to transmit HF, VOX off. |
| 03 16 38 | CC | Sigma Seven, Cape Cap Com. Do you read? We are approaching LOS. |
| 03 16 59 | P | This is Sigma Seven broadcasting on HF. Deke, how do you read this now? |
| 03 18 30 | P | It should be noted that the ammeter is reading 12 amps as advertised—apparently, somebody is getting to me with a R Cal on the cabin $O_2$. The ammeter is just about exactly on 12 amps. |
| 03 18 56 | P | There is a slight rate in yaw about a half degree per second, it's almost impossible to take out without having to fly it out. This does look like an appropriate time to get ready for an HF check. Turning the VOX to push-to-talk. |
| 03 20 04 | CC | Sigma Seven, this is Cape Cap Com. Transmitting HF, for a voice check. At 03 10—MARK. (03 20 11) $^T$. |

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| 03 20 18 | CT | Sigma Seven, this is Canary Com Tech. Transmitting HF check at 03 20 21, MARK, out. (03 20 24) T. |
| 03 20 32 | CT | Sigma Seven, this 03 20 30 Kano. |
| 03 22 49 | P | Going to VOX record. Looking at the window with sunglow all over it. It definitely is a smoked pattern with streaks of light. Powdery debris on it—some of it has a pink color, sort of a pinkish-orange color. Probably from the RTV 90 sealing devices that were around the rings and sealing parts of the system—the tower jettison system. |
| 03 23 25 | P | Definitely have a reduced visibility as a result of this. The rates, at this point, at 3 23 35, MARK (03 23 35) T are almost all zeros. |

## CANARY ISLANDS (THIRD PASS)

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|---|---|---|
| 03 23 49 | CC | Sigma Seven, this is Canary Cap Com. Transmitting on UHF/HF. |
| 03 24 00 | P | Hello, Ca . . . |
| 03 24 06 | CC | Sigma Seven, this is Canary Cap Com. Transmitting on HF/UHF. How do you read? |
| 03 24 45 | P | Canary Cap Com, this is Sigma Seven. UHF. Do you read me? Over. |
| 03 25 26 | P | This is Sigma Seven. On HF. Canary Cap Com, I read you. Did you read me? Over. |
| 03 25 36 | CC | Roger. Sigma Seven, this is Canary Cap Com. |
| 03 25 42 | P | Roger. I'm having a ball up here drifting. Enjoying it so much I haven't eaten yet. I'm going to start to eat now. Over. |
| 03 25 55 | CC | Sigma Seven, this is Canary Cap Com. Do you still read? |
| 03 25 58 | P | That's affirmative, Canary. Do you read me? |
| 03 26 01 | CC | I read you about 4 by 4. |
| 03 26 03 | P | Roger. |
| 03 26 05 | CC | How's everything now? |
| 03 26 06 | P | Very good. |
| 03 26 14 | P | At this point, I definitely have a feeling of flying along yawed, 90 degrees, rolled right 30 degrees, and pitch almost right on the horizon. |
| 03 26 30 | CC | Roger. Sigma Seven. I did not read. |
| 03 26 33 | P | Roger. I have a slight yaw rate about a half degree per second. I'm recording as well as transmitting, naturally, and I appear to be yawing right around into proper yaw angle. |
| 03 26 54 | CC | Sigma Seven, this is Canary Cap Com. You're unreadable. |
| 03 26 57 | P | Roger. |
| 03 27 33 | P | In VOX record. I've just checked the stick out—while in drifting flight—to see if I would get any rates built up by stroking the stick, and I did not. It's working beautifully. |
| 03 31 11 | P | Visor open—now. |

## KANO (THIRD PASS)

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|---|---|---|
| 03 32 14 | P | Kano. |
| 03 32 18 | CT | Sigma Seven, this Kano Com Tech. Transmitting on HF. Do you read? |
| 03 32 22 | P | Kano Cap Com, this is Sigma Seven. On HF. I read you. Do you read me? Over. |
| 03 32 43 | CC | Sigma Seven, this is Kano Cap Com. How do you read? |
| 03 32 56 | CC | Sigma Seven, this is Kano Cap Com. How do you read? |
| 03 33 07 | P | Kano Cap Com, this is Sigma Seven. I read you loud and clear, How me? Over. |
| 03 33 12 | CC | Roger, Seven. I read you—fairly weak and a little garbled. |
| 03 33 20 | P | Roger. How do you read me now? I'm on push-to-talk, HF. Over. |
| -- -- -- | CC | [I read you very weak, Seven.] G |
| 03 33 41 | CC | Sigma Seven. How do you read? |
| 03 33 43 | P | This is Sigma Seven, I read you loud and clear. How do you read me? Over. |
| 03 34 06 | CC | Sigma Seven, this is Kano Cap Com. Do you read? Over. |
| 03 35 59 | CC | Sigma Seven, this is Kano Cap Com. Transmitting on UHF. |
| 03 36 08 | CT | Sigma Seven, this is Kano Com Tech. Transmitting on HF. Do you read? Over. |
| 03 36 26 | CT | Sigma Seven, Sigma Seven, this is Kano Com Tech. Transmitting on HF. Do you read? Over. |
| 03 36 35 | P | This is Sigma Seven. I read a station on HF. Say again. Over. |
| 03 36 40 | CT | Sigma Seven, this is Kano Cap Com. Transmitting on HF. Do you read? Over. |
| 03 36 46 | P | Kano Com Tech, this is Sigma Seven. I read you loud and clear on HF. How me? |
| 03 36 54 | CT | . . . . |

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|---|---|---|
| 03 40 06 | P | Indian Ocean Ship, this is Sigma Seven. Over. |
| 03 40 14 | P | Indian Ocean Ship. Sigma Seven. Over. |
| 03 41 29 | P | Indian Ocean Ship. Sigma Seven. Over. |
| 03 42 20 | P | Indian Ocean Ship. Sigma Seven. Over. |
| 03 43 07 | CT | Sigma Seven, Sigma Seven, this is IOS Com Tech. Do you read? Over. |
| 03 43 12 | P | Indian Ocean Ship, this is Sigma Seven. I read you loud and clear. How me? |
| 03 43 23 | CT | Sigma Seven, this is Indian Com Tech. I read you loud and clear. Stand by for Indian Cap Com. Over. |
| 03 43 30 | P | Roger. |
| 03 43 32 | CC | This is IOS Cap Com. |
| 03 43 40 | CT | This is Indian Ocean Ship Com Tech. Sigma Seven. Go ahead, please. |
| 03 43 46 | P | Indian Cap Com, this is Sigma Seven. Over. |
| 03 43 49 | CC | Roger. I read you now. Over. |
| 03 43 51 | P | Roger. I read you, too. |
| 03 43 55 | P | You got T/M on me? Over. |
| 03 43 58 | CC | That is Roger. |
| 03 43 59 | P | Okay. I'm going to power up the ASCS bus. |
| 03 44 02 | CC | Say again? |
| 03 44 04 | P | I'm going to power up. |
| 03 44 06 | CC | Roger. Understand. You're going to power up. |
| 03 44 12 | P | Inverter on. All okay. Turned it on at 44 [minutes]. |
| 03 44 28 | P | I'm on fly-by-wire at this time. |
| 03 44 55 | CC | Sigma Seven, Sigma Seven. I've lost communications. |
| 03 45 02 | P | Roger. |
| 03 45 18 | CT | Sigma Seven, this is Indian Com Tech. Do you read? Over. |
| 03 45 21 | P | Indian Com Tech. Affirmative. I heard you loud and clear. |
| 03 45 24 | CC | Roger. This is IOS Cap Com. Standing by. Over. |
| 03 45 27 | P | Roger. |
| 03 45 34 | CC | Sigma Seven. We have just been advised that we have visual sighting at this time. Over. |
| 03 45 38 | P | Roger. I'll have to go by and say hello. |
| 03 45 42 | CC | Roger. |
| 03 46 28 | CC | . . . over. |
| 03 47 55 | CC | Sigma Seven, Sigma Seven, this is IOS Cap Com . . . . |
| 03 52 08 | P | On the powering up. I went to gyros normal, finally, after getting gyros set at approximately three zeros with the maneuver off. There was no high thruster transition. Then, when I set up for three zeros, I did get a high thruster transition in the reentry select attitude. However, this is probably due to the no rate gyro run up case. |
| 03 52 41 | P | I am flying at three zeros on ASCS mode at this time, to see if this helps me reestablish. At approximately 4 hours, I just find out where I am as far as the moon goes. |
| 03 52 56 | P | Having little trouble getting stars oriented as to which ones they are, and this is going to be the problem. Particularly with two gadgets to hold in your hand for a computer. This doesn't help one bit. |
| 03 53 17 | P | There is a star that occurs at 3 hours and 53 minutes. What it is, is going to take a while to find out. Read the computer, set up, 3 hours and 53 minutes, and the time at 55, set up to a standard—56 minutes . . . standard . . . . |
| 03 54 09 | P | I should have the moon—in sight—by now—and do not. Therefore, I better go searching for it. |
| 03 54 37 | P | Going to fly-by-wire low. Gyros free. |
| 03 55 10 | P | Going to gyros caged. Gyros are caged. |
| 03 55 51 | P | There's Cassiopeia which is to the north. |
| 03 57 08 | P | There's our friend the moon. We're due over Muchea at what time, 4 hours—get set up then. |
| 03 57 48 | P | Gyros are going to be . . . . |

## MUCHEA (THIRD PASS)

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| 03 58 04 | CC | . . . Muchea. Over. |
| 03 58 05 | P | Muchea Cap Com, this is Sigma Seven. |
| 03 58 10 | P | Hello. Hello, Muchea Cap Com. Sigma Seven. |
| 03 58 15 | CC | Sigma Seven, Sigma Seven, this is Muchea Cap Com. Do you read? Over. |
| 03 58 21 | P | This is Sigma Seven. I read you loud and clear, Muchea. How me? |
| 03 58 38 | P | Muchea Cap Com. Sigma Seven. I read you loud and clear. How me? |

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| 03 58 42 | CC | How do you read? |
| 03 58 58 | CC | Sigma Seven, Sigma Seven, this is Muchea. Do you read? |
| 03 59 03 | P | Muchea Cap Com, this is Sigma Seven. On UHF. How do you read me now? Over. |
| 03 59 10 | CC | Sigma Seven, Sigma Seven, this is Muchea. On UHF. Do you read? |
| 03 59 15 | P | Sigma Seven. I read you loud and clear, Muchea. How me? |
| 03 59 19 | CC | Roger. Read you and clear also. I called you two or three times on HF and got no answer. You're loud and clear on UHF. How's your status? |
| 03 59 28 | P | Roger. My status is fine. |
| 03 59 31 | CC | Are all systems under control? |
| 03 59 33 | P | That's affirmative. I just used the moon to lock on. I will give you a short report. I'm just going to go on the ASCS . . . if you watch my thrusters. |
| 03 59 45 | CC | Roger. |
| 03 59 50 | P | I will go on ASCS; reentry attitude. |
| 03 59 55 | CC | Roger. You're on now according to us. |
| 04 00 02 | P | Roger. I'm just about going in. I'm not on it. Ha, Ha. |
| 04 00 12 | P | Okay. I'm going in it now, on gyros free. I'm going to go to gyros normal. |
| 04 00 21 | P | Okay, Gene. I'll give you a readout on what we've got up here. |
| 04 00 24 | CC | Okay. |
| 04 00 31 | P | First off, I'm in auto reentry; I'm in auto; gyros are normal; maneuver is off; all configuration is of reentry; bypass switch for rate gyros is in normal. Give you a fuel readout, the auto tank is 90 [percent], manual is about 90 [percent]. Give you a read on the suit which has been very comfortable now. The suit temperature is 60 [degrees]. My dome is down to 45 [degrees]. I'm going to back it off a half a notch. I'll go to 0 and then come back up again. Over. |
| 04 01 18 | CC | Okay, Wally. Stand by. |
| 04 01 27 | S | Sigma Seven. How about blood pressure? |
| 04 01 33 | P | On the way. |
| 04 01 36 | CC | Roger. John Glenn suggests that you have time when the numerous particles first appear, at sunrise, to tap the side of the capsule, and test his favorite theory. |
| 04 01 57 | P | Roger. I have done that, Gene, and they do come from the capsule. |
| 04 02 03 | CC | Roger. And he suggests later on, when they appear like white particles, that you do the same and this might prove that they are the same particles. |
| 04 02 11 | P | I tried that too. |
| 04 02 13 | CC | You got the same result? |
| 04 02 14 | P | That's affirmative. |
| 04 02 15 | CC | Roger. |
| 04 02 43 | CC | Sigma Seven. If you're not doing anything, can you give us an attitude readout? |
| 04 02 47 | P | Okay. My indicated attitudes are 0 degrees pitch, 10 degrees left yaw, 0 degrees roll. Over. |
| 04 03 07 | CC | We concur. Very good. |
| 04 03 09 | P | Roger. How do the scanners look? |
| 04 03 21 | CC | Within 4 degrees, Wally. They are consistent, also. |
| 04 03 26 | P | Roger. I think I got the bear lined up pretty well, then. |
| 04 03 30 | CC | Roger. Everything looks very good here. You sound very good, and it looks like go for 6. I think from here I'll just ask the doctor in. |
| 04 03 39 | P | Okay. |
| 04 03 41 | S | How do you feel? |
| 04 03 42 | P | Very good. I'm enjoying the ride very much. |
| 04 03 46 | S | Excellent. |
| 04 03 54 | P | You can tell Chris I got bored racking around and I just decided to give him his auto retro. Actually auto reentry attitude at this point. Over. |
| 04 04 06 | CC | Roger. |

## WOOMERA (THIRD PASS)

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| 04 04 27 | CC | Sigma Seven. Woomera Cap Com. |
| 04 04 30 | P | Hello, Woomera. Go ahead. |
| 04 04 35 | CC | Sigma Seven. Woomera Cap Com. Did you say you were going to auto retro? |
| 04 04 41 | P | Negative. I'm in auto reentry at this point. |
| 04 04 45 | CC | Roger. We received your Muchea report, and we're standing by. |
| 04 04 51 | P | Roger, Woomera. Thank you. |
| 04 04 57 | CC | What is your comfort control valve suit setting? |

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| 04 05 03 | P | Roger. It is now set at 7.5. I went back to 0 and came back up again. Over. |
| 04 05 15 | CC | [Roger.] [G] Would you repeat that last part? |
| 04 05 17 | P | Say again? |
| 04 05 19 | CC | We received you going to zero, but we didn't know what it was set at. |
| 04 05 24 | P | Roger. 7.5. |
| 04 05 26 | CC | [All systems] [G] green at Woomera. |
| 04 05 29 | P | Roger. My suit dome is 62 degrees at this time. |
| 04 05 37 | CC | Suit dome 62 [degrees]. |
| 04 05 38 | P | Correct. |
| 04 05 41 | CC | Thank you. You . . . . |
| 04 05 50 | CC | You reported the suit dome at 45 [degrees] over Muchea. Is this correct? |
| 04 05 55 | P | That's correct. It moved that fast. |
| -- -- -- | CC | [Good.] [G] |
| 04 06 28 | CC | We are about to have LOS here at Woomera. |
| 04 06 32 | P | Roger. |
| 04 06 33 | CC | Anything else for the Cape? |
| 04 06 35 | P | Negative. Everything's going along fine here. |
| 04 06 39 | CC | Roger. |
| 04 08 29 | P | Roger. At this period, I'm looked ahead at the flight plan. I frankly feel that a lot more star information is needed, for nailing down attitudes—or a better computer. I'm rapidly working here when I shouldn't have to be. |
| 04 11 20 | P | At 4 11, it is 1 15 on the star chart computer, . . . . |
| 04 11 30 | ? | . . . . |
| 04 11 44 | P | I have Jupiter off on the right side, right corner of the window. |
| 04 12 07 | P | . . . Altair. |
| 04 12 15 | P | I can see the double stars of Grus all forming a line—coming right into the center of the window. Jupiter, of course, is a real bright one. I can see Ankaa and—correction Al Na'ir, and that, this must have been Peacock. Al Na'ir is slightly to the right of the flight path. I'm flying, but that must be her. Jupiter shows up in the corner of the window. Proper head position, Fomalhaut shows up to the right of flight path. Jupiter in the right corner. It checks at this time. Very nice. |
| 04 15 21 | P | . . . . |
| 04 15 58 | P | Don't tell me this compass is working? I should talk more. What I have been doing, I have been getting the standard source of light out. At this point, for the capsule, for my face because I am looking straight up at the compass is really rolling in the plane of the roll axis. I have a North pointing toward my right elbow. The compass definitely takes a swing when I move. |
| 04 17 32 | P | The compass is too much affected by the attitude instruments and gyros behind them. That's why I can't bring it too close to them. I am holding it just about halfway between the instrument panel and my face and in reference to a line halfway between the glove box and the pack. At the c.e.t. of 4 18, it is pointing directly at the forward hatch clamp line. It seems that this is the restraining pin link for the hatch. I guess they can stow that for future reference. |
| 04 18 57 | P | . . . get rid of that for awhile. |
| 04 19 04 | P | We are on time 4 hours and 19 minutes. On ASCS and I will pitch down. At this point, going to fly-by-wire low—to reentry attitude for Hawaii. |
| 04 19 35 | P | Selecting reentry attitude. |
| 04 19 45 | P | Always surprising when you finally see some object and the rate really shows up. |
| 04 20 09 | P | I am stopping the capsule in reentry attitude. Taking roll out. Yaw is zero; roll is coming out. I want to acquire this, and then watch it. Roll looks good. Pitch is coming in; Yaw is coming in. Rates and attitude are good. . . . ASCS a little low thruster tweek and very nice. I will warm up the $T_r$–10 gyros for their benefit. And starting to get some light on the scope, just barely. |
| 04 21 49 | P | I have a feeling I am off in pitch, but I think it is that damn horizon airglow line. Makes you think it's higher than it is. I still have the feeling, though, that I am pitched down about 10 degrees further than I want to be. If we are that close, we will let the scanner work on the problem. |
| 04 22 44 | P | Now we are indicating retroattitude. We are fairly close to it. So the scanners are torquing it up about 5 degrees I'd say. |

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| 04 22 55 | CC | Sigma Seven. Hawaii Cap Com. |
| 04 22 59 | P | Roger. Hawaii Cap Com, this is Sigma Seven. How do you read? |
| 04 23 02 | CC | We are reading you okay now. How about giving a short report? |
| 04 23 06 | P | Okay, good. I am in ASCS; retroattitude; gyros are normal; the maneuver switch is off. I am warming up the $T_r$–10 bypass for the rate gyros. I still have fly-by-wire low selected. All quantities and systems are green. I am green. |
| 04 23 31 | CC | Roger. Could you give me your cabin dome temperature, and cabin temperature, and valve setting. |
| 04 23 38 | P | Roger. The suit dome is 68 [degrees]. The cabin dome is 48 [degrees]. The suit setting is 7.5. The cabin setting is 3. Over. |
| 04 23 59 | CC | Roger. Give me your cabin temperature, suit temperature, and inverter setting. |
| 04 24 04 | P | Okay. Cabin temperature is 92 [degrees], and I'll give you inverters. Stand by. Main inverter is, 250 inverter is about 143 [degrees]. The 150 is 102 [degrees]. Standby is about 115 [degrees]. |
| 04 24 28 | CC | Wally, I cut you out there. Give me your water valve setting on your inverter. |
| 04 24 33 | P | On the inverter it is 4. |
| 04 24 38 | CC | Roger. |
| 04 24 40 | P | That seems to work pretty well so far for the whole flight, Gus. |
| 04 24 43 | CC | Okay. Fine. Cape feels you are in good shape, Wally, and so I have good news. They give you a go for 6 orbits. |
| 04 24 48 | P | Hallelujah. |
| 04 24 51 | CC | They request you stay in retroattitude, and go ahead and prepare for retro like you would normally. |
| 04 24 58 | P | I understand. |
| 04 25 00 | CC | And remain in retroattitude until you pass your [recovery area] retro 3–1 time. |
| 04 25 04 | P | I understand. |
| 04 25 06 | CC | And then proceed with your flight plan. |
| 04 25 08 | P | Okay, Gus. I will see you out there shortly. |
| 04 25 11 | CC | Roger. |
| 04 25 45 | P | These attitudes look honest as can be, Gus. |
| 04 25 48 | CC | Roger. |
| 04 25 52 | P | How do the scanners check out with you? |
| 04 25 55 | CC | You're looking real good down here, Wally. We can see nothing wrong. |
| 04 25 57 | P | Good deal. I use the moon and then, later on, Jupiter, to line up some of the other stars. A little too dim to bet on every time. |
| 04 26 07 | CC | Roger. |
| 04 26 11 | P | The star computer device I have helps a lot to confirm stars, but it's a little hard to acquire them to begin with. |
| 04 26 19 | CC | Roger. |
| 04 26 30 | CC | I guess the only thing I don't have is your suit inlet temperature. Could you give me that? |
| 04 26 32 | P | Roger. 62 [degrees]. |
| 04 26 35 | CC | 62 [degrees]. That sounds good. |
| 04 26 37 | P | Yeah. It's been very comfortable since I finally got that final setting. |
| 04 26 41 | CC | Roger. |
| 04 26 45 | CC | How much water have you had, Wally? |
| 04 26 47 | P | I took a big sip awhile ago, and then I just had a tube of peaches and a couple of those cubes. |
| 04 26 53 | CC | Okay. Good. |
| 04 26 54 | P | Now it looks like a good time to take a drink of water. Over you. |
| -- -- -- | CC | Visor open? |
| 04 27 15 | P | My visor is open now. |
| 04 27 18 | CC | Roger. Visor open. |
| 04 27 52 | CC | Wally, give me your pressure . . . readout. |
| 04 27 56 | P | Just a second, Gus, I am trying to stow this water hose. |
| 04 27 59 | CC | Okay. |
| 04 28 01 | P | Partial pressure oxygen. |
| 04 28 06 | CC | Say again. |
| 04 28 08 | P | Are you asking for $PO_2$? |
| 04 28 10 | CC | Roger. |
| 04 28 13 | P | Okay, stand by. That is about 4.2 [psi] and I am back on the suit again. |
| 04 28 21 | CC | Roger. |

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| 04 28 23 | P | That is actually as pure as we normally would have it. That is why I didn't want to stay on too long. |
| 04 28 29 | CC | Roger. Check your visor close. |
| 04 28 32 | P | Roger. The visor is closed and sealed up. Suit visor bottle is way up in the green. |
| 04 28 40 | CC | Roger. |
| 04 29 09 | P | Well, Gus. We—at least we got some fuel coming over here this time. |

## CALIFORNIA (THIRD PASS)

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| 04 32 12 | CC | Sigma Seven. Cal Cap Com. |
| 04 32 14 | P | Cal Cap Com, this is Sigma Seven. Read you. Do you read me? Over. |
| 04 32 18 | CC | Roger. Read you loud and clear, Wally. Looks like it is all go for a next orbit. Do you concur? |
| 04 32 25 | P | Roger. Everything feels good here, John. |
| 04 32 32 | CC | Roger. Standing by for your report. |
| 04 32 34 | P | Roger. I am in ASCS auto at this time; in reentry attitude; the gyros are normal; maneuver is off; all systems are green. Auto fuel is 89 [percent], manual is 90 [percent]. My temperatures at this point are very comfortable. The suit inlet is 62 [degrees], the dome is 69 [degrees]. I believe I am all set to power down. Over. |
| 04 33 12 | CC | Roger. That's next on the flight plan here. You are all set to power down if you concur. And I would like to check your clock setting. What do you have on the clock there? Over. |
| 04 33 21 | P | Okay. I will give you a mark at 30 seconds. |
| 04 33 24 | CC | Your ECT I have here. What's your setting for retrosequence? Over. |
| 04 33 27 | P | Roger. 08 hours+50+21. |
| 04 33 32 | CC | Roger. Thank you. |
| 04 33 38 | CC | What is your cabin pressure, Wally? |
| 04 33 40 | P | Roger. The cabin pressure is just about 5.1 psia. |
| 04 33 45 | CC | Okay. Sounds good. |
| 04 33 47 | P | Right. Not much time for that one for this orbit is there, John? |
| 04 33 56 | CC | What? Say again, please? |
| 04 33 57 | P | There wasn't much time to get ready for coming down, coming down this time was there? Sorry I couldn't go back to Hawaii for you this way. I'll see you out there, I guess. |
| 04 34 09 | CC | Wally, yeah. Right here at the end of six. Do you have any comment with regard to relative motion of those particles that you saw? Did you see any of them moving past, or did you see any of them coming toward you if you were facing in the direction of flight? Over. |
| 04 34 23 | P | I never had the direct opportunity of them coming toward me, John, but they definitely were going away from me. I could get a big blast of them, either green fireflies or white ice crystals, by rapping on the capsule almost any time. |
| 04 34 38 | CC | Roger. If you happen to have a chance at sunrise, any time between now and end of flight, you might see whether you can see any coming toward you during that period also. |
| 04 34 47 | P | Roger. Understand. |
| 04 34 49 | P | Okay. I am going to shove off for a relaxation period. |
| 04 34 53 | CC | Good show. Understand you are going to power down. |
| 04 34 55 | P | That's affirm. I'll give you a readout on it, so you can watch it. |
| 04 34 56 | CC | [Roger] [G]. |
| 04 35 03 | P | Going to fly-by-wire. Going to gyros caged. |
| 04 35 09 | CC | Roger. |
| 04 35 11 | P | Gyros are three zeros at this time. ASCS bus off. I have 0 volts. |
| 04 35 23 | P | Roger. Powering down the beacons, ground command. |
| 04 35 26 | CC | T/M's dropped. |
| 04 35 27 | P | Roger. I have 12 amps at this time. |
| 04 35 31 | CC | Roger. That's what we show. |
| 04 35 32 | P | Roger. Okay, I am going from fly-by-wire back to normal now, so I can keep a cold stick. |
| 04 35 42 | CC | Roger. |
| 04 35 44 | P | Okay. I am in normal, and I am going to reentry attitude select for powering up time. |
| 04 35 59 | P | And she's all set. |
| 04 36 17 | CC | . . . this is Cal, you are looking good. . . . see you next time around. |
| 04 36 21 | P | Righto, John, and thanks so much for your help. |
| 04 36 23 | P | Roger. |



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| 04 36 35 | P | At 04 36 37. I took a light reading, and the light value is 13 for ASA 160. |
| 04 36 47 | CC | Roger. Got it. |
| 04 36 51 | P | I'll see if I can flounder around with the camera now and get a picture of the Baja. |
| 04 36 57 | CC | Roger. I understand getting a picture of Baja California. |
| 04 37 00 | P | I am just breaking out the camera now, John. |
| 04 37 02 | CC | Okay, very good. |
| 04 37 03 | P | Right. I'm sure I'll be ready for it though. |
| 04 37 49 | P | Okay. Setting in 11—and we can look down towards the Salton Sea again—on infinity. |
| 04 38 02 | CC | Yeah. That's a pretty good setting from up there. |
| 04 38 04 | P | Yeah. . . . actually, I am looking north of the Salton Sea because of the yaw effect I must have in here. There is just a slight yawing effect just left of the capsule. Maybe about a quarter of a degree per second. Enough to bring me up towards the U.S.A. |
| 04 38 44 | CC | Roger. Understand. Little slow yaw rate to the left. You are beginning to fade a little bit here. Probably won't get you much longer. |
| 04 38 51 | P | Okay. I'm yawing to the right. Sorry I misled you. |
| 04 38 55 | CC | Roger. |
| 04 40 10 | P | Going to VOX record. |

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| 04 40 14 | P | Roger. Stand by 1 second, Deke. |
| 04 40 41 | P | Roger. Made a dosimeter check, and it is still less than the last reading. |
| 04 40 46 | P | Cape Cap Com, Sigma Seven in UHF–high. Go ahead. |
| 04 40 59 | P | Cape Cap Com, this is Sigma Seven, UHF–high. Go ahead. |
| 04 41 04 | CC | Go ahead, Sigma Seven. This is Cape Cap Com. |
| 04 41 10 | P | Cape Cap Com, Sigma Seven UHF–high. How do you read? |
| 04 41 13 | CC | You are now coming in about 4 by. |
| 04 41 17 | P | Roger. I am in drifting mode, everything is working beautifully. |
| 04 41 24 | CC | . . . |
| 04 41 26 | P | Say again. |
| 04 41 29 | CC | . . . |
| 04 41 33 | P | You are coming in garbled, Deke. |
| 04 41 35 | CC | Here are your retro times, if you are ready. |
| 04 41 38 | P | Roger. I think I will be through in a second. I will take them. |
| 04 41 41 | CC | Roger. |
| 04 41 45 | CC | [Recovery area] 4–2 is 05 44 05. |
| 04 41 53 | P | Do that one over again and I will be right on. You're in clear now. |
| 04 41 57 | CC | Okay. 4–2 is 05 44 05. |
| 04 42 04 | P | Okay. 4–2 is 05 44 05. |
| 04 42 09 | CC | Right. [recovery area] 6–1 is 08 51 24. |
| 04 42 14 | P | 24. |
| 04 42 16 | CC | [Contingency recovery areas] A and B are nominal and I'd like to give you a G.m.t. hack and see what your clock is doing now. Give you one at 16 57 35. MARK (04 42 26)T. |
| 04 42 28 | P | Roger. I'm reading 55 45. |
| 04 42 31 | CC | Pretty good. |
| 04 42 32 | P | Let's check the backup clock and we will hack that. |
| 04 42 35 | CC | Roger. |
| 04 42 37 | P | Any time. |
| 04 42 41 | CC | For your information, we are going to start calling you Venus. IOS visually sighted you on the last pass. |
| 04 42 49 | P | How about that? |
| 04 42 52 | CC | Did you have your steak? |
| 04 42 54 | P | Yeah. Did you? |
| 04 42 56 | CC | Yeah. It was okay. Did you eat it? |
| 04 42 59 | P | Would you do me a time hack again on G.m.t.? |
| 04 43 02 | CC | Okay, G.m.t. 16 58 15. MARK. (04 43 06)T. |
| 04 43 08 | P | 15 okay. I'm 15—that was just about 3 seconds slow on my backup clock. |
| 04 43 15 | CC | Very good. Flight would like to talk to you now. |
| 04 43 17 | P | Okay. |
| 04 43 19 | CF | Wally, we have some Echo sighting data. You prepared to copy? |
| 04 43 24 | P | Just get my pencil out. Stand by. Okay. Go, Chris. |
| 04 43 28 | CF | 00 17 30 is contact time for 4 minutes. Azimuth 99.5 [degrees], elevation 90 [degrees]. Echo will be in the light, the capsule in the dark. |
| 04 43 46 | P | That should be fun, shouldn't it? |
| 04 43 47 | CF | Roger. Been a real good show up there. I think we are proving our point, old buddy. |
| 04 43 52 | P | I hope so, Chris. I am enjoying it. |
| 04 43 55 | CF | Roger. |
| 04 44 09 | CC | Sigma Seven . . . standing by. |
| 04 44 12 | P | Roger. |
| 04 44 34 | CF | Sigma Seven, Cape Flight. |
| 04 44 35 | P | Okay, Flight. |
| 04 44 38 | CF | We are ready to go into fast time if you are. |
| 04 44 40 | P | Ha, Ha, Ha, Ha, Ha! That's a good one. Very good. |
| 04 45 08 | CF | Sigma Seven, Cape Flight. |
| 04 45 10 | P | Go ahead there, Chris. |
| 04 45 12 | CF | The . . . retrosequence now shows 08 51 21 which means you can advance it exactly 1 minute and that would be the correct time. You can do that any time you want to. |
| 04 45 25 | P | Advance it 1 minute? |
| 04 45 28 | CF | Affirmative. That would be 08 51 21. |
| 04 45 32 | P | Okay. I will throw a minute in now. You reading me all right? |
| 04 45 36 | CF | Affirmative. |
| 04 45 37 | P | Okay. |

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| 04 45 44 | P | . . . That's a trick. Okay, I got 08 51 20. I'll throw another second in. I've got 08 plus 51 plus 21. |
| 04 45 46 | CF | Roger. We concur. |
| 04 46 00 | P | Roger. |
| 04 46 01 | P | Ah boy, I just happened to drift into an inverted position right now. For some reason or another, you can tell that the bowl was upside down. |
| 04 46 56 | P | Cape Flight, Sigma Seven. |
| 04 47 00 | CF | . . . |
| 04 47 04 | P | You can tell Cape Sir John that we have practically nothing on the naval engagement. |
| 04 47 27 | CC | Sigma Seven, this is Cape Cap Com. We did not get your message to Sir John. |
| 04 47 31 | P | Roger. Never mind. |
| 04 47 33 | CC | . . . Cape Cap Com. |
| 04 48 24 | P | I took picture 4, —4a at 4 48 29, which is the coast of United States. I assume—I will have to look at my map shortly and see where we are. A rather large cloud mass at this point. We will stow the camera again. The drift rate isn't consistent enough that you can just take a picture and then put the camera away. Plus, the camera is a little hard to take out and put back in again. |
| 04 49 23 | P | At 4 hours and 50 minutes, I can't get that camera back out of that box again. Time to take a picture. Better stay in there for awhile. |
| 04 50 01 | P | Camera will not work in [to] the glove box favorably. |
| 04 50 21 | P | Reading at light value 13½, and a . . . inside. |
| 04 50 36 | P | . . . |
| 04 50 51 | P | I punched the wrong button twice. I did not get a picture of the iris. |
| 04 50 57 | P | I am just about straight down. We will take some cumulus pictures. The time hack is 4 hours 51 minutes. The picture will be a 5a color. |
| 04 52 13 | P | The dome [temperature] is holding at 70 degrees. Cabin dome is 50 degrees. Suit inlet is comfortable at 62 [degrees]. Suit pressure is steady at 5 psia. Very interesting cloud formation for picture 6b on the color back. Rather nice collection of circular clouds. |
| 04 52 46 | P | . . . shot at 250 5 6. [1/250 second at f 5.6]. |
| 04 53 52 | P | At 04 53 53. Bit of in a rolled over attitude with the nose fairly high. . . . the light value [setting] was 13. |
| 04 54 17 | P | I can actually see the little object that looked like a snowflake this time, going away from the capsule; in the same flight path, of course. Definitely, looked like a piece of white, but it is quite visible against the black sky that I see now. . . . the stars that go away from us. Definitely has a different velocity than the capsule itself. |
| 04 55 29 | P | 4 55 and still am sighting some of the snowflake effects. 250 inverter is now approximately 135 degrees. Suit dome [temperature] is 72 [degrees]. The cabin dome is about 46 [degrees]. |
| 04 56 47 | P | Sun right in view again . . . that should be the proper yaw angle, approximately, because that's where the sun would be at sunset. |
| 04 57 02 | P | Coming up on 5 hours, so I'll be getting prepared to copy the intermediate report at this time. I will not put the camera all the way in the case at . . . |
| 04 57 44 | P | . . . |
| 04 58 21 | P | Capsule is working very well at this point. 250 [inverter] is 132 [degrees], 150 [inverter] is . . . 5. Standby [inverter] is 120 . . . thrusters . . . right, over 100 [degrees] left. Pitch down [thruster] is 105 [degrees]. Pitch up [thruster] is 100 [degrees]. Cabin heat exchanger [setting] is 4.0. Roll left manual [thruster] is 79 [degrees]. Roll right auto [thruster] is 110 [degrees]. Roll left auto [thruster] is 105 [degrees]. Think we will go back and pick up the retro. Temperature is 80 [degrees]. This is at almost exactly 5 hours. |
| 04 59 59 | P | Ready for the 5 o'clock report. Fuel is 89–90 [percent]. Oxygen 56–75 [psi, in hundreds]. Suit inlet is . . . . Dome [temperature] is 70 [degrees]. Cabin dome [setting] is . . . 0.8. That should be enough for now. |
| 05 00 50 | P | Got more targets of opportunity. |
| 05 00 59 | P | At 5 hours and 1 minute I am shooting pictures of weather almost vertically. There is a light value of 13½. Gives me 250 and 5 6 [1/250 second and f 5.6] roughly. Infinity is the setting. |
| 05 01 46 | P | Light value of 13 for that same subject. I shot at 13½. Seems like a very low setting. |

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| 05 03 00 | P | If I don't talk much more than this, it won't be very long to real time this tape recorder. Coming up on IOS at 5 hours and 15 minutes. Quite obvious that you don't care really what attitude you are in. There is always that concern about trying to get back into the attitude you must be in. Particularly, when you are coming around at the end of the third orbit to buy off on a go or no-go. |
| 05 04 20 | P | When I get much more, I look at the earth. Rates at this time, having powered down at approximately 4 hours and 35 minutes, are almost exactly 0. There is a very, very slight pitch rate. Approximately maybe ½ degree per second. |
| 05 05 16 | P | . . . stowing the camera again . . . to get out until after . . . . |
| 05 06 28 | P | Okay, should be coming up on Africa pretty soon. Tip her over and see how she looks without light. |
| 05 06 43 | P | . . . sunlight in my eyes now. Get a tan on this flight at last. |
| 05 07 39 | P | Hello Ascension, hello Ascension. This is Sigma Seven. Over. |
| 05 07 52 | P | Hello, Ascension, hello Ascension. This is Sigma Seven. Over. |
| 05 08 10 | P | Hello, Ascension, hello Ascension. This is Sigma Seven. Over. |
| 05 08 38 | CC | Sigma Seven, Sigma Seven, Ascension Cap Com on HF. Do you read? |
| 05 08 46 | P | This is Sigma Seven. I read a station, very garbled, please identify. |
| 05 09 46 | P | At this point in time, which is of course just prior to sunset, we are coming up with a batch of the white particles. They show up in the blue sky. I have the horizon almost in sight. And they are drifting away from me. |
| 05 10 08 | P | Let's check and see if we actually do get yaw out of these. They are tending to go up in relation to me, rather than tending to draw away aft. With this kind of lighting I can really see the illusion of visibility, due to the external problem of having smoke on the outer panel. Definitely is not on inner panels. It is quite easy to see by changing panels through reflections that it's the outer panel. |
| 05 11 05 | P | We are now going into night coming up on 5 hours 11 minutes. Suit dome is setting at 7.0 very happily. Suit itself is at 62 [degrees] and I am happy. |
| 05 11 28 | P | Testing, 1 2. |
| 05 11 36 | P | I have some pretty stars in sight, and also I have the little white objects that seem to come from the capsule itself and drift off. If they are a yaw check, it's fantastic. I suspect that the star I see is Arcturus. It would be very interesting—it is neither. It is one of the white objects. . . . two stars are staying quite still. The white object actually looked like it came toward me, but it wasn't. I can actually see the particle now, flying off as John described it, as a lathe shaving. It's a very good description of it. |
| 05 12 39 | P | My rates are now just about 0 in all three axes. I still have light in the periscope, of course. I am looking straight up and yet at this point which is . . ., that my attitude is—let me get into the couch here. I really can't pick it too well, I am just about inverted at this point, and that my nose is above the horizon. As a result I notice that these particles keep tending aft of me, relative to me at any time. |
| 05 13 48 | P | Periscope is blacking out rather rapidly at sunset. |
| 05 13 57 | P | It is almost blacked out completely at this point. It is really not usable. |
| 05 14 45 | P | Getting a real burst of light in the window. I really don't know what it is. At this point I should be coming up on the sunset. Five hours 15 minutes. Periscope is dark. I must be just getting a last look at the horizon; yet I'm not down on it. Here we go into night rather rapidly. Now we're into the night side. I am apparently pointed towards the surface of the earth, as I can see clouds with lightning in them. |

## INDIAN OCEAN SHIP (FOURTH PASS)

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| 05 15 53 | P | Indian Ocean Ship, this is Sigma Seven. How do you read? Over. |
| 05 15 58 | CC | . . . with a little bit of background noise. Over. |
| 05 16 05 | P | Roger. I have to run my volumn up to read you. I am talking UHF-high at this time. I am drifting, and I suppose dreaming. I understand you saw me last time, over. |
| 05 16 20 | CC | That is Roger. We had a 5 minute visual sighting for about 9 degrees or over. |
| 05 16 28 | P | Very good. Looks like you've got some lightning down your way now. |
| 05 16 33 | CC | Do you have an intermediate report for me at this time? |
| 05 16 36 | P | That's affirmative. Are you ready to copy—all systems were green at the time. At 5 hours fuel was 89 [percent] auto, 90 manual. Oxygen 56 [psi, in hundreds] primary, 75 secondary. Were you copying? |
| 05 17 07 | CC | Roger. I have your load and oxygen only at this time. |
| 05 17 12 | P | Roger. The fuel quantity, did you get that? |
| 05 17 15 | CC | Negative. |

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| 05 17 16 | P | Okay, 89 [percent] automatic, 90 manual. |
| 05 17 24 | CC | Roger. Your gyros and maneuver switch? |
| 05 17 27 | P | Okay, gyros are caged, maneuver switch is off. I am powered down. |
| 05 17 35 | CC | Roger. We have request from the Cape for a blood pressure reading since they did not get one at pass over at MCC. Over. |
| 05 17 41 | P | Okay. You deserve one anyway. Coming up. In addition, I would like to give you the suit inlet temperature, which was 62 degrees. |
| 05 17 54 | CC | Roger. |
| 05 17 55 | P | The suit dome [temperature] is 70 degrees and the circuit is comfortable. |
| 05 18 03 | CC | Wonderful. We also have a request from the Cape. On your next pass over California, between 6 08 and 6 10, they are going to pass your voice to live TV. Over. |
| 05 18 19 | P | Roger, understand at 6 08 to 6 10. |
| 05 18 23 | CC | They would like you to say something to the live TV audience at that time. Over. |
| 05 18 27 | P | Roger. |
| 05 18 39 | P | At this time I will perform an orientation test. Missed the manual fuel [handle] by 2 inches, and capsule repressurization [handle]. |
| 05 18 58 | P | Try to touch the yaw attitude [indicator], touched the yaw attitude [indicator] at 270 degree indication. Try to touch the manual emergency rate lever. And I will—I put my hand right on it. I believe I am through on this test over the other [yawning]—I'm yawning—by considerable margin. |
| 05 19 39 | CC | Sigma Seven, this is IOS Cap Com. |
| 05 19 41 | P | Go ahead. |
| 05 19 42 | CC | Readouts at this time? |
| 05 19 44 | P | Say again. |
| 05 19 45 | CC | Anything you want from the ground readouts at this time? |
| 05 19 49 | P | Negative, looks like everything's clean. I guess there's not much sense in giving me scanners because I'm pretty well cruising along here. |
| 05 20 00 | CC | Roger. Do you have your time on your intermediate report? |
| 05 20 05 | P | That was at 5 hours 00 minutes 00 seconds. |
| 05 20 09 | CC | Good. |
| 05 21 39 | P | I can see my attitude now. I am—looks like it's pretty good attitude. It's pitched down about 55 or 60 degrees. |
| 05 21 54 | P | No, that's all wrong. I can now see that I must have been inverted. The horizon is coming into view, and some stars. |
| 05 22 59 | CC | Sigma Seven, IOS Cap Com. 1 minute to LOS. |
| 05 23 02 | P | Roger, IOS. Thank you for your cooperation and enjoyed talking with you. |
| 05 23 28 | P | IOS, I'm going to try HF again after I leave you just to see how we do. |
| 05 24 16 | P | Indian Ocean Ship, this is Sigma Seven on HF. How do you read? ~~Over~~. |
| 05 24 47 | P | IOS, this is Sigma Seven on HF. How do you read? Over. |
| 05 25 04 | P | This flight I think I can take a whack at this photometer at last. |
| 05 25 25 | P | Turn off the cabin lights first. It's off. Extincted—total loss. |
| 05 26 33 | P | Getting—getting a good look at Orion at this time. Beautiful view of it. There are the Pleiades, Aldebaran. I'll look at Aldebaran and see what I can do with that. |
| 05 27 18 | P | I have extincted Aldebaran to read at 05 27 27. Now this experiment isn't going to be valuable; I need cabin lights to see. It's awfully hard to find the extinction photometer. Let's see if I can do it now. Contrasted Aldebaran, the standard source, under the same lighting conditions. Extincted at 3.8. |
| 05 28 08 | P | I'm unable to run any more tests on stars at time. I am coming back to the view of the surface of the earth. There's quite a bit of moonlight, and as a result the horizon is very bright. |
| 05 28 29 | P | I'll put the photometer in an area where it may be available again. At 05 28 48, the rates are almost exactly—negative—yaw is 0; pitch is $-\frac{1}{2}$; and roll is roll left $\frac{1}{2}$. We definitely have a cold stick. |
| 05 30 59 | P | This quiet time must be getting to a lot of people on the ground. I think we should probably put some more data in here. Gathered at 5 hours and 31 minutes. And about this time they want an intermediate report. We'll get it for them. |
| 05 32 57 | P | Okay. We'll take an electrical check. Main bus is 24 [volts]—isolated bus is—clicking because of the clock, of course—and that's 27 to 27$\frac{1}{2}$ (volts). |

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| 05 33 27 | P | Hello Muchea Cap Com, this is Sigma Seven. I read you. How me, over? |
| 05 33 36 | CC | Sigma Seven, this is Muchea Cap Com. I think I read . . . say again. |
| 05 33 44 | P | Roger. This is Sigma Seven. I read you loud and clear, Gene. There is no change in my status. Over. |
| 05 33 56 | CC | Sigma Seven, this is Muchea. I did not read you very well, but would request blood pressure. Doctor Berry would appreciate blood pressure during last three orbits. |
| 05 34 13 | P | Roger, Gene. I say there is no change in my status since the last report at 0500. Over. |
| 05 34 26 | CC | Roger. Understand no change in status since your last report. |
| 05 34 32 | P | That is correct; all quantities are the same. |
| 05 34 36 | CC | All quantities are the same. |
| 05 34 38 | P | Roger. And temperatures. Gene, I do have one change. The 250 inverter is now 120 [degrees]. |
| 05 34 59 | CC | Roger. Check, 250 inverter is now 120 [degrees]. |
| 05 35 05 | P | Very good. |
| 05 35 11 | CC | Roger. We do not have telemetry, so if you pressed your blood pressure button, it isn't doing us any good. If we get telemetry, we'll give you another call. |
| 05 35 21 | P | I was wondering how the heck you were gonna get it. It will go onboard (tape recorder) though. All d-c power is 25 volts or greater. Over. |
| 05 35 33 | CC | Say again. |
| 05 35 34 | P | All d-c power, d-c, is 25 volts or greater. Over. |
| 05 35 48 | CC | Did you say d-c volts are 25? |
| 05 35 52 | P | That is affirmative. All of them—they are all in good shape. |
| 05 36 40 | P | This is Sigma Seven, at 5 hours, 36 minutes, 45 seconds. No yaw rate, a slight left roll rate of ½ degree per second. A slight pitch up of ¼ degree per second. |
| 05 37 23 | CC | Sigma Seven, this is Muchea. I have not read your transmissions for the last minute. Hand you over to PCS. |
| 05 37 32 | P | Roger, Muchea. |

## PACIFIC COMMAND SHIP (FOURTH PASS)

| | | |
|---|---|---|
| 05 37 47 | P | Hello, Pacific Command Ship, Pacific Command Ship. This is Sigma Seven on HF. Over. |
| 05 38 05 | P | Hello, Pacific Command Ship. PCS, this is Sigma Seven. HF. Over. |
| 05 42 20 | P | Hello PCS, PCS. This is Sigma Seven. How do you read? Over. |
| 05 42 30 | CC | Sigma Seven, PCS. We read you weak but readable. How me? |
| 05 42 33 | P | I read you loud and clear, Al. And nice to talk to you today. |
| 05 42 40 | P | . . . |
| 05 42 44 | P | I am talking on HF at this time. |
| 05 42 52 | CC | Stand by, Seven. |
| 05 42 53 | P | Roger. |
| 05 43 10 | CC | Seven, this is Cap Com. Anything you want to say. |
| 05 43 13 | P | Nothing in particular. Wanna say hello to you though. All the systems are perfect. There are no changes in quantities since the 05 00 summary. Over. |
| 05 43 30 | CC | Roger. We have one message for you. They would like to attempt to contact you over Hawaii through the relay airplanes. So, would you please go up to UHF prior to acquisition of Hawaii? Over. |
| 05 43 46 | P | I understand, Al. Roger. |
| 05 43 53 | CC | We do not have T/M as yet. We might pick it up in a couple of minutes. |
| 05 43 57 | P | Right. I'm—very far south of you as you know. How's the weather there? |
| 05 44 04 | CC | You sound a little scratchy to me, Wally. |
| 05 44 06 | P | Roger. We're still pretty far apart. How is your weather there? |
| 05 44 13 | CC | Say again. |
| 05 44 14 | P | How is the weather there? |
| 05 44 18 | CC | Weather actually is fairly good here in location. I think on your next pass you might be able to see the typhoon. I'll give you a bearing and distance when you come over next time. |
| 05 44 27 | P | Very good. We had quite a flap on this suit circuit for the first orbit as you may know. |
| 05 44 40 | CC | Sorry, Seven. Not reading you very well. |
| 05 44 42 | P | Roger. I said we had a lot of trouble with the suit circuit in the beginning of the flight. |
| 05 44 53 | CC | Sigma Seven, you're breaking up too much. |
| 05 44 55 | P | Roger. I'll be back. |

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|---|---|---|
| 05 45 00 | CC | Why don't you—why don't you take a rest for awhile, you've been talking quite a bit. |
| 05 45 06 | P | Good show. |
| 05 46 00 | CC | . . . Hawaii. |
| 05 46 10 | P | That is correct, Al. And we'll talk better next time around. |
| 05 46 16 | CC | Roger. See you next time. |
| 05 46 18 | P | Roger. It's real nice up here today. |
| 05 47 33 | P | At this point I'm in VOX record. I'm going to switch to UHF for relay aircraft in Hawaii area. The time is 05 hours 47 minutes 44 seconds. |
| 05 47 49 | CC | . . . I'll give you a mark on g.e.t. of 05 48 00—3, 2, 1. MARK. (05 48 02)$^T$ g.e.t. 05 48 00. |
| 05 48 08 | P | Roger. I had that 03 seconds. I am 3 seconds fast on you, Al. |
| 05 48 16 | CC | Understand 3 seconds fast. |
| 05 48 18 | P | That is correct. |
| 05 48 20 | CC | Roger. |
| 05 48 22 | P | I am going to switch to UHF at this time. You are really crystal clear here. |
| 05 48 28 | CC | Roger. See you next time. |
| 05 48 29 | P | Roger. |
| 05 48 51 | P | This is Sigma Seven, broadcasting in the blind on UHF-high. Does anybody read? Over. |
| 05 49 05 | ? | . . . |
| 05 49 21 | P | Hello Huntsville, hello Huntsville, this is Sigma Seven. Do you read my UHF-high? Over. |
| 05 49 46 | ? | . . . |
| 05 50 09 | P | At 05 hours, 50 minutes, I have a yaw rate of ½ degree per second right, a pitch rate of ½ degree per second up, a roll rate of ½ degree per second left. |
| 05 50 41 | CC | Sigma Seven, Sigma Seven, this is . . . Cap Com on HF, do you read? |
| 05 50 47 | P | This is Sigma Seven, station calling, I can just barely hear you over. |

## WATERTOWN (FOURTH PASS)

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| 05 50 56 | CC | Sigma Seven, Sigma Seven, this is Watertown Cap Com on HF. If you are copying me, Cape Flight requests that you go to UHF, go to UHF, and try to contact the relay aircraft. I say again—in the blind, Cape Flight requests that you go to UHF and attempt to contact the relay aircraft. |
| 05 51 20 | P | This is Sigma Seven, read you loud and clear, Watertown. I have been on UHF. |
| 05 51 26 | P | Relay aircraft, this is Sigma Seven. Please patch in Hawaii. Over. |
| 05 51 40 | CC | Sigma Seven, Sigma Seven, this is Watertown Cap Com. Cape Flight requests that you go to UHF—go to UHF—and attempt to contact relay aircraft. |
| 05 51 51 | P | This is Sigma Seven. I am on UHF. Understand requirement. |
| 05 51 57 | P | Relay Aircraft, Relay Aircraft, this is Sigma Seven. Over. |
| 05 52 14 | P | Relay. . . . |

## HAWAII (FOURTH PASS)

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|---|---|---|
| 05 52 15 | CC | Hawaii Cap Com. |
| 05 52 16 | P | Hi, Gussy. How are you reading me? |
| 05 52 20 | P | Hawaii Cap Com, this is Sigma Seven. I just read you loud and clear. |
| 05 52 38 | CC | Sigma Seven, Sigma Seven, Hawaii Cap Com. |
| 05 52 42 | P | Hawaii Cap Com, this is Sigma Seven. Read you loud and clear. How me? |
| 05 52 54 | P | Hawaii Cap Com, Sigma Seven. I read you very clear and loud. Over. |
| 05 53 09 | CC | Sigma Seven, Sigma Seven, this is Watertown Cap Com on HF. If you read, go to UHF, go to UHF, and attempt to contact relay aircraft. |
| 05 53 29 | P | Hawaii Cap Com, Hawaii Cap Com, Sigma Seven. Over |
| 05 53 56 | P | Hello, Hawaii Cap Com. This is Sigma Seven. Over. |
| 05 53 59 | P | Hawaii Cap Com, Hawaii Cap Com, this is Sigma Seven. Over |
| 05 55 56 | P | This is Sigma Seven, giving the effects of flying inverted in a sunrise, 90 degrees yaw. It is the most obvious thing to you, what your direction of path is. Like looking out of a railroad train window. You see the terrain going by you. There are clouds of all varied types. I can see them sweeping by me just by the 90 degree plane—in the—90 degrees to the longitudinal axis of the vehicle. Very, very graphic display of yaw. As I swing around now, my blunt end is starting to go into proper yaw attitude although I am inverted. I see a small island at this point. And it's nice and bright in the cockpit again. We have light at approximately 5 56 this pass. There, we're almost swung around into yaw now. |

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| 05 57 10 | CT | Sigma Seven, Sigma Seven, Hawaii Com Tech. How do you read? Over. |
| 05 57 14 | P | This is Sigma Seven, UHF-high. I read you loud and clear. How me? |
| 05 57 26 | P | Hawaii Com Tech, Sigma Seven. Read you loud and clear. How me? Over. |
| 05 57 31 | CT | Sigma Seven, Sigma Seven, Hawaii Com Tech. How do you read? Over. |
| 05 57 34 | P | I read you loud and clear, Hawaii, how me? I believe I just saw Midway that time. Be back down that way a little later. That was right about 5 . . . 7 to 6 and looking back. |
| 05 57 54 | CT | . . . do you read? |
| 05 57 56 | P | Hawaii Com Tech, Sigma Seven. Loud and clear. |
| 05 58 08 | CT | Sigma Seven, Com Tech, Hawaii. How do you read? |
| 05 58 13 | P | Hawaii, Sigma Seven. I read you loud and clear. |
| 05 58 16 | CC | Sigma Seven, this is Hawaii, this is Hawaii Cap Com. |
| 05 58 19 | P | Hi, Gus. How are you doing? |
| 05 58 21 | CC | Real good. How about you? |
| 05 58 22 | P | Oh, fine. I'm not bored up here. I just flew over Midway a while ago. Got a good look at that. I'm steaming up towards you-all now, of course, north of you. I gave Gene Duret my intermediate report—if he could pick me up on HF. Actually . . . |
| 05 58 45 | CC | Go ahead with your report. |
| 05 58 46 | P | Okay. As you know, the control mode is set up for drifting. The mode selected is normal, auto, gyros caged. I've selected reentry attitude. I'm of course in fly-by-wire low. The maneuver switch is off. I'll give you the fuel quantities and oxygen. Just to check yours against mine. I still have 89 [percent] auto and 90 [percent] manual. |
| 05 59 20 | CC | Roger. Was that 89–90? |
| 05 59 22 | P | That's affirmative 89–90. |
| 05 59 25 | CC | Roger. |
| 05 59 26 | P | Oxygen, I have 55 and 75 [psi, in hundreds]. |
| 05 59 31 | CC | Roger. |
| 05 59 33 | P | At 05 hours no minutes no seconds, I have 56 [psi, in hundreds] on the oxygen and 75. There is practically no change on it. |
| 05 59 45 | CC | Roger. |
| 05 59 46 | P | Suit inlet temperature is still about 61 to 62 [degrees]. The dome is about 72. It's about as cool as I want it. It's just beautiful. |
| 05 59 57 | CC | Roger. We confirm those quantities, Wally. Looks like you're in good shape. Did you get the message to go to UHF prior to elapsed time of 6 18? |
| 06 00 08 | P | Right. I have that on my card, also Watertown got it to me on HF. But neither Watertown nor you could hear me. I heard you loud and clear. |
| 06 00 19 | CC | Were you reading me through relay? |
| 06 00 20 | P | That's affirmative. So I would suggest to you, broadcast in the blind if you have something hot for me, |
| 06 00 26 | CC | Roger. I'll do that anyway, and I'm glad to hear that you got us at least. |
| 06 00 30 | P | Right. I heard you way back and, I'd say at about 5 hours and 53 minutes. |
| 06 00 39 | CC | Say that time again. |
| 06 00 40 | P | Five hours and 53 minutes. |
| 06 00 43 | CC | Repeat the whole tie. I missed it. |
| 06 00 45 | P | Five hours 53 minutes. |
| 06 00 49 | CC | Roger. |
| 06 01 03 | P | Sure breaking tradition on this pass. |
| 06 01 07 | CC | Roger. How do you like drifting flight? |
| 06 01 10 | P | Great sport. The rates are not consistent. They do change. |
| 06 01 17 | CC | Roger. Understand. Your rates do change. |
| 06 01 19 | P | That's affirmative. I've never had more than about, of, I would say about ¾ of a degree per second in any one direction. |
| 06 01 30 | CC | Wally, you're cutting in and out on voice. Possible we're losing it. |
| 06 01 34 | P | Okay. Can you read me better with the push-to-talk? |
| 06 04 33 | P | At 6 hours and 4 minutes—we have a 1 degree per second right yaw rate; 0 degree per second pitch; and ¾ of a degree per second left roll. No change in fuel quantity. No detectable thruster action. We are swinging around and acquiring the horizon at this point. |

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| 06 05 48 | P | California Cap Com, this is Sigma Seven. Over. |
| 06 06 04 | CC | Hello Sigma Seven, this is Cal Cap Com. How do you feel? Over. |
| 06 06 07 | P | Read you loud and clear, John. How me? |
| 06 06 09 | CC | You're loud and clear. Everything's solid down here. I guess you got the word on the 6 08 bit. Is that affirm? |
| 06 06 14 | P | That's affirmative. You have T/M on me now? I'll power up before all that jazz. |
| 06 06 20 | CC | Okay. Roger. T/M is solid. |
| 06 06 21 | P | Okay. I have gyros normal, auto, gyros caged. I am going to power up and then go—correction—gonna power up and fly-by-wire. Monitoring the a-c bus at this time. She comes up to 115 [volts]. I have 25 amps, in good shape. |
| 06 06 45 | CC | Roger. We confirm. |
| 06 06 47 | P | I'll hold off on my beacon. Clock's at 6 06 approximately I guess, when I powered up, so that it would be good at about 6 11. I have no change in consumables, John. It looks real good here. |
| 06 07 06 | CC | Roger. Everything's looking fine here. We have T/M solid and we confirm your actions here. |
| 06 07 11 | P | Roger. I got a real weird attitude at this point. I'll clue you. Ha, ha, I'm looking down at the earth. I'm sort of coming toward you head first, inverted. |
| 06 07 23 | CC | Roger. You can pick your own up from that standpoint. |
| 06 07 26 | P | Yeah. You really get the illusion you're ready for a split S every once in a while, don't you? |
| 06 07 33 | CC | Right. |
| 06 07 40 | CC | Wally, I'll give you a count to the 6 08 here so we . . . start in. They're going to have it on for 2 minutes beginning at 6 08. That's about 20 seconds, here. |
| 06 07 46 | P | Okay, John. Sounds like fun. |
| 06 08 04 | CC | Okay, Sigma Seven. This is Cal Cap Com. You're at 6 08. Two minutes on live TV. Go ahead, Wally. |
| 06 08 10 | P | Roger, John. Just came out of the powered down configuration where we had the ASCS inverter off. It came up in good shape and will stay on now for the rest of the flight. The amps and volts are reading properly. The amps are now down to about 19 amps, after we powered up. They were up to 25 at first. I'm coming toward you inverted this time, which is an unusual way for any of us to approach California, I'll admit. |
| 06 08 44 | CC | Roger, Wally, you got anything to say to everyone watching you across country on this thing. We're going out live on this. |
| 06 08 50 | P | That sounds like great sport. I can see why you and Scott like it. I'm having a trick now. I'm looking at the United States and starting to pitch up slightly with this drifting rate. And I see the moon, which I'm sure no one in the United States can see as well as I right now. |
| 06 09 08 | CC | I think you're probably right. |
| 06 09 09 | P | Ha, ha. I suppose an old song "Drifting and Dreaming" would be apropos at this point, but at this point I don't have a chance to dream. I'm enjoying it too much. |
| 06 09 22 | CC | Things are looking real good from here, Wally. |
| 06 09 24 | P | Thank you, John. I guess that what I'm doing right now is sort of a couple of Immelmanns across the United States. |
| 06 09 37 | CC | Roger. Wally, have you had a chance to observe a haze layer any? |
| 06 09 42 | P | Yes, I have. It's quite fascinating; in fact, it's misleading in the evening. Gives you the feeling that you are pitched down quite far. Have you noticed that? |
| 06 09 54 | CC | Roger. |
| 06 09 55 | P | It's projected up much higher in the evening. |
| 06 10 06 | P | Ah, I see you got me on a Z Cal. |
| 06 10 12 | CC | Negative. Did not send Z Cal. Over. |
| 06 10 14 | P | Oh, somebody did. Maybe Scotty. |
| 06 10 18 | CC | May have. |

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| 06 10 19 | CC | Roger . . . Z Cal off now. |
| 06 10 22 | P | See, you can't be sneaky with me, can you Scott? Now I got the $PO_2$ [oxygen partial pressure], which goes to 0 when you do that. Okay, R Cal. How's that? Anybody want blood pressure. |
| 06 10 34 | CC | Say again, Wally. |
| 06 10 36 | P | Okay, I'll send you blood pressure now. |
| 06 10 40 | CC | Roger, standing by. Cal coming off. |
| 06 10 44 | P | Blood pressure on. |
| 06 10 54 | CC | We have your blood pressure. Standing by for a standard report. |
| 06 10 58 | P | Roger, Scott. I am in drifting flight, but I have powered up the ASCS a-c bus. It has come on the line very well. I will power up the beacons later. The control mode selected is fly-by-wire, although I'm not controlling in it. The auto switch is auto, gyros switch is still caged. The reentry attitude is selected, maneuver is off. The quantities are all in the green. Suit temperature is about 60 [degrees]. I'm quite comfortable with it. Electrical is green and a-c is green. |
| 06 11 47 | CC | Roger. And could we have one more blood pressure, please. I didn't get the last. Your [recovery area] 5–1 TORF [time of retrofire] I have. Are you ready to copy? |
| 06 12 00 | P | Let me get that first. Then I'll give you the blood pressure. |
| 06 12 03 | CC | Roger. 07 18 10. |
| 06 12 06 | P | 07 18 10. |
| 06 12 10 | CC | That's Roger. At 07 18 10, and for your information, Ascension copied you on your last pass and they are standing by to copy you again this time. |
| 06 12 21 | P | Roger. I'll send you a BPMS. |
| 06 12 23 | CC | Roger. |
| 06 12 27 | P | I have your 07 18 10. |
| 06 12 31 | CC | That is Roger, 07 18 10 for [recovery area] 5–1. |
| 06 12 35 | P | Roger. |
| 06 13 03 | CC | Incidentally, Wally, if we have LOS before we read the last of your blood pressure, don't forget to turn her off. |
| 06 13 12 | P | Roger. Thank you. |
| 06 13 22 | P | Going to VOX record only momentarily. |
| 06 13 26 | P | Now in the dosimeter check, it is still reading less than $\frac{1}{10}$ on the lowest scale. |
| 06 14 40 | P | [Picture] Able 8 taken at 06 14 40. A coastline. It should have been the coast of . . . Tampico, just south of Texas. |
| 06 15 23 | P | All color shots have been made so far, no black and white. I'm going to try to take another shot here of a cloud structure, at 06 15 30. |
| 06 15 37 | P | Go ahead. Go ahead. Cape Cap Com. |

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| 06 15 45 | CC | Sigma Seven. Cape Cap Com. |
| 06 15 47 | P | This is Sigma Seven. Go ahead, Deke. |
| 06 15 50 | CC | Roger. You're coming in weak and intermittent. Can you read us? Over. |
| 06 15 54 | P | Roger. I'm coming up at this time at—just across the Yucatan peninsula here. |
| 06 16 05 | CC | Sigma Seven. Stand by. We're still not reading you. |
| 06 16 07 | P | Roger. |
| 06 16 25 | CC | Sigma Seven. Cap Com. Let's try it again. |
| 06 16 27 | P | Deke, this is Sigma Seven. Just passing over the Yucatan peninsula. |
| 06 16 35 | CC | Roger. You're still weak and intermittent. |
| 06 16 38 | P | Roger. |
| 06 17 04 | CC | Sigma Seven. Cap Com. How do you read now? |
| 06 17 06 | P | I read you loud and clear. How me? |
| 06 17 09 | CC | Roger. You are loud and clear. You were very garbled before. |
| 06 17 11 | P | Roger. I'm doing partial control on fly-by-wire low. Will acquire ASCS when I get in retroattitude. No problem, just the bird's flying beautifully, and give her a break. |
| 06 17 27 | CC | Roger. |
| 06 17 30 | P | When you have a yaw of 90 degrees, it's just like looking at a train window—that's all there is to it. That's about what I'm going through now. Just walking right around the horizon, Deke. |
| 06 17 44 | CC | [Roger] [G]. |
| 96 17 48 | P | Let's put a little . . . . |
| 06 17 49 | CC | . . . pressure for environment. |
| 06 17 51 | P | Say again, Deke. |
| 06 17 52 | CC | Give us a cabin pressure. |
| 06 17 54 | P | Roger. Stand by. Okay. It's about—just about 5 [psia] on the button. |
| 06 18 01 | CC | Roger. |
| 06 18 02 | P | Okay. |
| 06 18 06 | CC | Have you eaten yet? We haven't been able to confirm this. |
| 06 18 08 | P | That's affirmative. I had some peaches and a couple of cubes. I didn't want to eat it all up in one batch. |
| 06 18 15 | CC | That's a good idea. |
| 06 18 18 | P | Spread it out a little bit, you know. |
| 06 18 20 | CC | How are you feeling in general? |
| 06 18 23 | P | Very fine, Deke. It's the first time I've had a chance to relax since last December. I've been exercising a little bit to get my muscles toned up as well. Not exactly walking around but a little bit of stretching. |
| 06 18 42 | CC | . . . [You say—you say you are what?] [G]. |
| 06 18 46 | P | Roger. |
| 06 18 50 | CC | Did you say you'd like to get up and walk around? |
| 06 18 52 | P | I did a little exercise. |
| 06 18 54 | CC | Roger. Understand. |
| 06 19 01 | P | I'm just about in retroattitude now. Just about made a complete 180 [degrees]. |
| 06 19 13 | CC | [Roger Seven, Cape Cap Com . . ..] [G] |
| 06 19 15 | P | I'm going to pick up pitch very shortly. |
| 06 19 25 | CC [Auto 1] | Cape Cap Com. Auto One, do you read? |
| 06 19 39 | CC [Auto 1] | Sigma Seven, Sigma Seven. Auto One. Do you read? |
| 06 19 41 | P | This is Sigma Seven. Read you loud and clear. How me? |
| 06 19 49 | CC | Hello, Cape Cap Com . . . . |
| 06 19 55 | CC [Auto 1] | Sigma Seven, Sigma Seven. Auto One. Do you read? |
| 06 20 01 | CC | Go ahead. Cape Cap Com. |
| 06 20 16 | CC [Auto 1] | Sigma Seven, Sigma Seven. Auto One. Do you read? |
| 06 20 20 | P | This is Sigma Seven. I read you loud and clear. |
| 06 20 24 | CC [Auto 1] | Roger. Sigma Seven. Cape Cap Com. Auto One. |
| 06 20 33 | CC | . . . . |
| 06 20 35 | CC [Auto 1] | Roger, Cape Cap Com. Auto One. Contact . . . relay. |

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| 06 20 40 | CC | . . . Cape Com Tech. How do you read? |
| 06 20 44 | CC | How do you read Auto One? |
| 06 20 48 | CC | Roger. |
| 06 20 53 | CT [?] | Did you call Com Tech? |
| 06 20 55 | CC [?] | . . . . |
| 06 21 03 | CC [Auto 1] | Sigma Seven. Auto One. Do you read Cap Com? |
| 06 21 05 | P | That's affirm. What's your problem? |
| 06 21 15 | CC [Auto 1] | Sigma Seven, Sigma Seven, this is Auto One. Can you read Cape Com Tech? |
| 06 21 19 | P | That's affirmative. For God sakes. |
| 06 21 32 | Warfare [1] | Auto One. Warfare. Do you read me? |
| 06 21 34 | CC [Auto 1] | Roger. Auto One. Reading Warfare loud and clear. |
| 06 21 38 | CC | Roger. Go bravo then. |
| 06 21 41 | CC [Auto 1] | Roger. Bravo. |
| 06 21 46 | CC | Auto Two Bravo. |
| 06 21 58 | ? | Mercury will pick it up. |
| 06 22 10 | Warfare | Auto Two. Warfare. Do you read? |
| 06 22 12 | CC [Auto 2] | Auto Two reads Warfare. |
| 06 22 14 | Warfare | Roger. Give Sigma Seven a call. |
| 06 22 16 | CC [Auto 2] | Sigma Seven. Auto Two. Do you read? |
| 06 22 18 | P | This is Sigma Seven. I read you. What do you want? |
| 06 22 22 | CC [Auto 2] | Sigma Seven. Auto Two. Do you read? |
| 06 22 31 | CC | Hello Sigma Seven. Cape Cap Tech. How do you copy? |
| 06 22 34 | P | I copy you loud and clear, Murph. |
| 06 22 36 | CC | Roger. Stand by for Cape, please. |
| 06 22 38 | P | Okay. |
| 06 22 45 | CC | Sigma Seven. Cap Com. How do you read now? |
| 06 22 48 | P | Read you loud and clear, Deke. How me? |
| 06 22 50 | CC | Much better. Got you through Grand Turk relay now. |
| 06 22 53 | P | Oh! How 'bout that. I'm now in auto reentry mode. Over. |
| 06 23 03 | CC | Understand. Auto retro mode. |
| 06 23 05 | P | Negative. Auto reentry mode. |
| 06 23 09 | CC | Roger. Understand. Reentry. |
| 06 23 11 | P | Roger. And she looks like she's really well lined up. |
| 06 23 16 | CC [Auto 1] | Sigma Seven, Sigma Seven. Auto One. Do you read? |
| 06 23 26 | CC [Auto 1] | Sigma Seven, Sigma Seven. Auto One. Do you read? |
| 06 23 36 | CC | . . . . |
| 06 23 41 | CC [Auto 1] | Sigma Seven, Sigma Seven. Auto One. Do you read? |
| 06 23 59 | CC [Auto 1] | Sigma Seven, Sigma Seven. Auto One. Do you read? |
| 06 24 06 | P | Auto One, this is Sigma Seven. I read you. How do you read me? Over. |
| 06 24 15 | P | This is Sigma Seven on VOX record only. I have reestablished auto mode in normal with no high thruster action. At this point I have 85 percent auto, 90 percent manual. And I feel, now that I am on ASCS, I can do some experiments where before I was not able to. I will now pitch the capsule down on fly-by-wire low. First I will check to see—if I turn on my beacons, nobody down here can get to me on those. At 6 hours and 25 minutes—if anybody has a beacon in South America they deserve to hear it. Beacons are on, for a good 3 amps. Opening visor to wipe off chin, and I think I'll take a drink of water. |

[1] Relay aircraft communicator at Cape Canaveral.

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| 06 26 22 | P | Closing visor. Okay. Let's take a look and see where we are. At this point we made a dosimeter check. I will pitch down on fly-by-wire to reentry attitude. Now let's give it a manual proportional go this time. |
| 06 27 37 | P | In manual proportional, with manual lever pulled out, and having selected rate command, I'm slowly but surely coming into retroattitude. All axes are working very well. Setting up in roll. Getting yaw rates, pow, pow. And I want this to count—I'm going to go back to fly-by-wire low. |
| -- -- -- | P | That was stupid. Now we go to fly-by-wire low. I had a case of double authority and really flotched it. But better conserve our fuel. It's much too easy to get into double authority, even with the tremendous logic you have working on all these systems. The pitch is in; yaw is in; selecting reentry attitude; roll is in; going to ASCS, reentry now. And she's in. |
| 06 29 58 | P | Okay. I think we can change back, and get some weather bureau pictures if it's possible. Shoot up the rest—the rest of these, just lightly. That's A 10 at 6+30 hours, and 11 is coming up, and 6+30 hours with a cloud bank off to the left. Okay. I'll get the plate back on, and save this at A. Take the plate back out again, zap. Okay. That wound up, A 12 to go. |
| 06 31 23 | P | The capsule at this point is, at 6 hours and 31 minutes, it is under chimp configuration. I've used manual proportional to a great degree. I now have 79 [percent] in manual [fuel] and 81 [percent] auto. Let's see how we stand. Ah, 81, 80 auto, 71 manual. |
| 06 32 25 | P | I fouled up, oh shucks. |
| 06 33 07 | P | That's clever. Weather bureau back is finally out. First shot not worth using, so I'll change that. Okay. We got slider out. Weather filter in, if I can get it. This side toward lens. There, we got a filter in. I'm going to shoot at ASA 64. |
| 06 34 42 | P | Take a light value at 06 35, and that light value is 13 for 64 ASA. Very good. Fairly bright. . . . I'll give her 13, and we'll punch off a couple quickies because of the first bad one. First shot taken at 6 35 25. |
| 06 35 47 | P | Second shot 6 35 45. |
| 06 36 47 | P | Capsule is in perfect attitude. Ideal shots for weather bureau. Think I even put on finder at this time. Shooting black and white of the clouds. |
| 06 37 01 | P | In the white. Ready to shoot at 6—06 37 07. That was an oblique. Shot number 3. I'll take shot number 4 almost as straight down as I can sight. Beyond a little bit of shadow as we approach sunset. Okay, that was 6 37 34. |
| -- -- -- | P | That's capsule elapsed time. At 6 38 we will copy the manual intermediate report and I can do that at this time. |
| 06 38 48 | P | Okay, at 6 hours and 35 minutes we are at 81 [percent auto fuel]—79 [percent manual fuel]. . . . cabin 90 [degrees] . . . suit 63 [degrees]. . . . Dome 71 [degrees]. |
| 06 40 25 | P | We're now at 6 40. Going to map two. |
| 06 41 43 | P | At this point, I made a complete electrical check. All electrical systems are green. The amps are about 19 amps. This is very logical after we've been inserted. The load has been diving over release of relays at $T_r+5$. |
| 06 42 04 | P | All the equipment is in good order. Coming up over IOS for 6+50, in the night, and this time I want to go down the star charts to check this bear out. That is why I am on ASCS. |
| 06 42 27 | P | Had the fun with experimenting and now will get the fun of being ready for reentry at any time. Okay. Let's see—we got IOS at 6 40. 6 40. . . . same as 0 52. |
| 06 44 03 | P | There is a nice interesting horizon. The sun is off to the left about—oh I'd say 40 degrees. There's a dark line of the surface of the earth, orange at the clouds—a light yellow, a light white and a blue band. A very light blue and I have the planet Mercury in sight at this point. Before the sun has set. And it's in the proper position. |
| 06 44 37 | P | Describing the blue band. There's a relatively dark blue band right at the surface of the earth and a light blue band, and another dark blue band, and a large white band which is the airglow, and then a deep black one and sorta goes from a grayish blue into a dense black. Almost looks like underneath a rain cloud as far as the transition from the blue band to the total darkness. And I'll bring up my fingertip lights. And at 06 45 52 Mercury is right on the horizon. Arcturus should be in view, but I guess we can't get her. |
| 06 45 45 | P | Okay, I [06 45 46]$^{T}$ see Mercury going through the—airglow. We'll see if she holds up. When I said "I see" that was the beginning of it. MARK, [06 46 10]$^{T}$ the first change of color, which is now a light blue. And it's still visible. MARK, [06 46 12]$^{T}$ a darker blue. Visible MARK, [06 46 16]$^{T}$ into the yellow orange of the surface of the Earth. This was—Mercury, dropping over the horizon. I should be picking up the Moon and Venus fairly soon. At 6 46—and at 6 48 I'm over IOS. |

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|---|---|---|
| 06 49 12 | P | Okay, it looks like we are getting some lighted areas over the southern tip of Africa. I definitely have a city in sight, and—this is Sigma Seven. On transmit, I've had on VOX record only. I definitely have a city in sight in Africa. It first showed up at 06 49 30 seconds. The lights come up very clear. I'm in retroattitude at this point to give a mark on my position, and the moon is on my flight path for yaw reference. |
| 06 50 07 | P | I'll bet you any money that city on my left was Port Elizabeth. |

INDIAN OCEAN SHIP (FIFTH PASS)

| | | |
|---|---|---|
| 06 50 43 | P | Indian Ocean Cap Com, this is Sigma Seven. Over. |
| 06 51 06 | P | Indian Ocean Cap Com. Sigma Seven. Over. |
| 06 51 26 | CC | Sigma Seven, Sigma Seven. Unable to read your transmission. Over. |
| 06 51 34 | P | Indian Ocean Cap Com. Sigma Seven. Over. |
| 06 51 37 | CC | Roger. I read you now. Over. |
| 06 51 39 | P | Roger. I read you weak. |
| 06 51 43 | CC | Do you have a short report for me? Over. |
| 06 51 45 | P | Roger. I'll give you my configuration. I am in auto, retro control mode; gyros are normal; maneuver switch is off; all consumables are in the green; electrical is checking out very well; capsule is tracking well. The moon is perfect reference at this point. It is right on the predicted path as well as Venus, as you probably know from down there. |
| 06 52 18 | CC | Roger. We have a c.e.t. You have about a plus 3 second lead on your c.e.t. |
| 06 52 27 | P | Would you give me a countdown on c.e.t., please. |
| 06 52 30 | CC | Roger. On my mark it will be 06 52 33. MARK [06 52 36]T |
| 06 52 38 | P | That was 33—that's about a 4 second difference. I see you have some good ole' lightning again. |
| 06 52 51 | CC | Sigma Seven. Not to mention the word, but will you send a BP? [blood pressure] Over. |
| 06 52 56 | P | Okay. |
| 06 53 35 | CC | This is IOS Cap Com. Standing by. |
| 06 53 38 | P | Roger. If you'll stand by I'm going to take a check on Venus, at this point, for extinction, to see how she looks. |
| 06 53 45 | CC | Roger. |
| 06 54 26 | P | Okay. Venus is extincted at 06 54 29, at a value of 5.2. |
| 06 54 40 | CC | Seven. What was the time you stated? |
| 06 54 44 | P | I'm just recording data. |
| — — — | P | The standard light is also extincted at 3.8. |
| 06 56 04 | P | Picture taken, 06 56 27, black and white, of the moon. With the weather bureau filter pulled out. Picture number 6. And as the moon sets we'll try one more at a lower shutter speed. Trying to hold it carefully. That's the second picture taken of the moon at moon set. At this point the camera back will be reinstalled and the camera stowed in case of retro attempt. |
| 06 57 12 | P | Hello! A pretty flash of light. |
| 06 57 52 | P | Camera is going to be stowed in the space dome. |
| 07 00 12 | P | . . . . |
| 07 00 24 | P | Auto beacons. Beacons are on power now. Camera is stowed. |
| 07 03 31 | P | Okay while I'm reading instruments, the 250 is 145 [degrees]. That is the 250 inverter. The 150 inverter is 105 [degrees]; and the standby inverter is 119 [degrees]; retro temperature is 75 [degrees]. Yaw right, 100 [degrees]; yaw left, 90 [degrees]; pitch down, 96 [degrees]; pitch up, 102 [degrees]; cabin heat exchanger, 42 [degrees]; roll left manual, 98 [degrees]; roll right auto, 108 [degrees]; roll left auto, 108 [degrees], samey, samey. Very good. And this report was made at 07 04 40. |
| 07 06 07 | P | All systems look very good at this point. This is as tight a vehicle as anyone can imagine. |
| 07 10 29 | P | At 07 hours 10 minutes and 30 seconds, I see a lighted area. Very well lighted. It shows up more like an airport. Better identify where that would be—that should be the Philippines. Possibly it's at Zamboanga, and that's 07 hours 10 minutes and 30 seconds. Very graphic series of lights. Very easy to see. |
| 07 11 38 | P | Correction, at 07 hours and minutes put me over. |
| 07 11 48 | P | . . . . It's marked on the chart at 07 hours and 10 minutes. I was looking down at—almost in retroattitude. It showed up very clearly. |
| 07 12 25 | P | Now we're getting a planet in sight. Roger. Jupiter. I can see a string of stars for Grus, and good ole' Fomalhaut—there in the upper corner, Grus coming down through the middle. And Fomalhaut coming right down middle. Very good. |

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| 07 13 24 | P | All attitudes seem to be checking out very well. Head and couch with scribe line works. My reticle at this, quick check on it. |
| 07 13 47 | P | Unable to dim reticle sufficiently for a night acquisition. MARK again. Grus that is, of the stars themselves in the window . . . . Taurus is coming right down through the center line. Could yaw right about 5 degrees which would satisfy dead reckoning. Then roll left about 5 [degrees] which is quite graphic. For retro, this looks like a very good setup. Be no problem at all flying attitude here with the moon bright . . . light which would be dawn's light. Occasionally you can see a ground light, particularly, along the island chain at this point. |

## PACIFIC OCEAN SHIP (FIFTH PASS)

| | | |
|---|---|---|
| 07 15 52 | CT | Sigma Seven, Sigma Seven, this is PCS Com Tech, PCS Com Tech. Do you read? Over. |
| 07 15 58 | P | This is Sigma Seven. Read you loud and clear. How me? |
| 07 16 02 | CT | Roger. Sigma Seven. Reading you 5 by, 5 by. Going to Cap Com. |
| 07 16 06 | P | Roger. |
| 07 16 10 | CC | Hello Seven. Standing by for your report. |
| 07 16 11 | P | Roger, Al. I am in auto; retro; the gyro switches are normal; manuever is off. The capsule is prepared for retrosequence but for stowing two charts. I'm sure we're go. I have 81 percent auto [fuel], 80 percent manual [fuel], which is the same as my intermediate report. They did not change. I have 52 [psi, in hundreds] on primary, 75 [psi, in hundreds] on secondary oxygen. Suit is go at 62 [degrees]. Same as before. |
| 07 16 53 | CC | Roger, Seven. I did not catch your manual fuel reading. You broke up a little bit. Will you give that to me please? |
| 07 16 58 | P | Roger. Manual is 80 [percent]. |
| 07 17 04 | CC | Roger. I have 81 [percent] auto, 80 [percent] manual, oxygen 5,200 [psi] and 7,500 [psi]. |
| 07 17 12 | P | That is correct. |
| 07 17 13 | CC | Well, I would say you were definitely go. We are out of contact with the Cape at the moment, but looks like you are good for the full route. |
| 07 17 20 | P | Right you are. Now my c.e.t., I guess, is about 3 seconds fast, as you know. |
| 07 17 29 | CC | Roger. Why don't you give me a time hack on it? |
| 07 17 31 | P | Okay. I'll give you a 35. MARK 35. [07 17 35] T. |
| 07 17 37 | CC | Roger. You are about 3 seconds fast. I show your TORF [time of retrofire] as 08 Volume 1 21. |
| 07 17 44 | P | Roger. That is what I have in. |
| 07 17 47 | CC | Your T/M on c.e.t. is also 2 seconds fast. The retrosequence for (contingency recovery area) 5-Echo is nominal. |
| 07 17 56 | P | Roger. 5 Echo, Al. It's a real ball. |
| 07 18 01 | CC | Man—sound like you're really enjoying it. I'll give you a few seconds of silence while I send through a calibration. |
| 07 18 07 | P | Okay. |
| 07 18 50 | CC | Seven, this is Cap Com. |
| 07 18 52 | P | Roger, I see you are still on R Cal. |
| 07 18 54 | CC | Affirmed. The R Cal is now off. |
| 07 18 58 | P | Roger. I have it coming off. |
| 07 19 00 | CC | We've been comparing the free surface effect of liquid on the center of gravity of the capsule, and we recommend that you drain the bilges prior to reentry. |
| 07 19 10 | P | Ha! Ha! Ha! |
| 07 19 11 | CC | It's during the coming orbit. |
| 07 19 13 | P | I'm concur. |
| 07 19 16 | CC | Also, Seven. At LOS, which should occur about 07 21, the typhoon will be located about 400 miles about 45 degrees left of your track. So you should be able to pick it up. |
| 07 19 31 | P | Oh, very good. I'll look for it. |
| 07 19 34 | CC | And we are reading you loud and clear and will be standing by for your HF check at 7 20. |
| 07 19 40 | P | Roger. |
| 07 19 42 | CC | If you have nothing further, I'll see you next time. |
| 07 19 45 | P | Okay. I'll drop in. |
| 07 19 49 | CC | Standing by. |
| 07 19 50 | P | Roger, Al. Thanks a lot. |
| 07 20 06 | P | Gyros are free. |
| 07 20 16 | CC | Seven. PCS. |

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| 07 20 22 | P | This is Sigma Seven. On HF. This is Sigma Seven. On HF. Giving a short count at 07 hours, 20 minutes, 34 seconds c.e.t. This is to check for HF coverage on the world wide range. The duration of the transmission is to last 60 seconds. I wish I knew what else I could say to eat up the time. If I breathe hard enough this might help. The capsule is working very well and I believe we are just about coming up on the end of a 60 second mark. Using HF transmit and record throughout the world wide range. And this is Sigma Seven. Checking out. |
| 07 21 31 | CC | Seven, this is PCS. Do you still read? |
| 07 21 34 | P | That is affirmative on HF. How do you read me, Al? |
| 07 21 38 | CC | Loud and clear, Wally. Could you, if you have time, give us a readout on how you are coming on your orientation tests? Over. |
| 07 21 44 | P | I seem to be improving. What I am touching is just these three items, but I get closer to them each time I whack at it. |
| 07 21 54 | CC | Very good. The head shrinkers will be delighted. |
| 07 21 58 | P | I guess they are out of a job altogether. |
| 07 22 01 | CC | Okay, Wally san. See you next time. |
| 07 22 02 | P | Righto, Al. Thanks again. |

## HUNTSVILLE AND WATERTOWN (FIFTH PASS)

| | | |
|---|---|---|
| 07 22 05 | CT | Sigma Seven, Sigma Seven, this is Huntsville Com Tech. |
| 07 22 10 | P | Huntsville Com Tech, this is Sigma Seven. On HF. Do you read? Over. |
| 07 22 15 | CT | Sigma Seven, Sigma Seven, this is Huntsville . . . . Sigma Seven, Sigma Seven, this is Huntsville Com Tech. |
| 07 22 38 | CC [HAW] | Sigma Seven. Hawaii Cap Com. Could you read me? |
| 07 22 41 | P | Huntsville Com Tech. This is Sigma Seven. On UHF. Hawaii Cap Com. I read you. Over. |
| 07 22 48 | CC | Sigma Seven, this is Cap Com. Over. |
| 07 22 53 | P | Roger. Huntsville, this is Sigma Seven. Read you loud and clear. Have you anything to relay to the Cape? Over. |
| 07 23 06 | P | Negative. Everything here is going hunky-dory. Apparently I am committed for six and I am very happy about it. The whole rig is running beautifully. In case Al couldn't relay my fuels. I have 81 [percent] auto, 80 [percent] manual, I am in auto, retro control mode at this point. |
| 07 23 30 | CC [HAW] | Sigma Seven. Please say again. Over. |
| 07 23 35 | P | Okay. I am in auto, retro control mode at this point. Gyros are free for the scanner test. |
| 07 23 54 | CC [HAW] | Sigma Seven. Will you give it to me HF, please? |
| 07 23 59 | P | Hawaii Cap Com. Can you read me UHF? Roger. Switching to HF. Stand by for warm up. |
| 07 24 15 | CC [HAW] | Sigma Seven. Say again UHF. |
| 07 24 24 | P | This is Sigma Seven. On HF. Do you read me HF? Over. |
| 07 24 31 | CT | Sigma Seven, this is Watertown Com Tech. I read you UHF. Over. |
| 07 24 34 | P | This is Sigma Seven. Watertown. On HF. I read you UHF. How do you read me? Over. |
| 07 24 48 | CT | Sigma Seven, Sigma Seven, this is Watertown. |
| 07 24 52 | CC | . . . are you still go? Over. |
| 07 24 58 | P | This is Sigma Seven. I am go. Sigma Seven. Switching UHF. |
| 07 25 13 | CC | Sigma Seven. Are you still go? Sigma Seven, Sigma Seven. Are you still go? Are you still go? |
| 07 25 42 | P | Hawaii Cap Com, Hawaii Cap Com. Sigma Seven. On UHF. I am very much go. Over. |
| 07 25 57 | CC | Sigma Seven, Sigma Seven, this is Watertown Cap Com. How do you read HF? Over. |
| 07 26 01 | P | Watertown, this is Sigma Seven. On HF—correction, I am on UHF-high. I read you HF loud and clear. |
| 07 26 09 | CT | Sigma Seven, this is Watertown Com Tech calling HF. How do you read? Over. |
| 07 26 16 | P | Watertown. Sigma Seven reads you loud and clear. |
| 07 26 27 | CT | Sigma Seven, Sigma Seven, this is Watertown Com Tech. How do you read HF? |



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| 07 26 36 | P | Watertown Cap Com, this is Sigma Seven. I read you loud and clear UHF. Over. |
| 07 26 47 | CT | Sigma Seven, Sigma Seven, this is Watertown Com Tech. On HF. How do you read? |
| 07 26 55 | P | Sigma Seven reads you loud and clear. Out. |
| 07 27 02 | CT | Sigma Seven, Sigma Seven, this is Watertown Com Tech. HF. How do you read? |
| 07 27 08 | P | This is Sigma Seven. Read you loud and clear. Out. |
| 07 27 15 | CT | Sigma Seven, Sigma Seven, this is Watertown Com Tech. HF. How do you read? |
| 07 27 31 | CT | Sigma Seven, Sigma Seven, this is Watertown Com Tech. HF. How do you read? |
| 07 27 44 | P | Hawaii Cap Com, Hawaii Cap Com. Sigma Seven. Do you read? Over. |
| 07 28 17 | P | Hawaii Cap Com, Hawaii Cap Com. Sigma Seven. Over. |
| 07 29 15 | CT | Sigma Seven, Sigma Seven, this is Watertown Com Tech. HF. How do you read? |
| 07 29 28 | CT | Sigma Seven, Sigma Seven, this is Watertown Com Tech. HF. How do you read? |

## HAWAII (FIFTH PASS)

| | | |
|---|---|---|
| 07 29 46 | CC | Seven. Hawaii Cap Com. Go ahead. |
| 07 30 07 | CC | Seven. Hawaii Cap Com. . . . over. |
| 07 30 12 | P | Hawaii Cap Com, this is Sigma Seven. How do you read now? |
| 07 30 34 | P | Hawaii Cap Com. Sigma Seven. |
| 07 30 41 | CC | Sigma Seven, Sigma Seven. Hawaii Cap Com. I read you. Over. |
| 07 30 45 | P | This is Sigma Seven. I read you loud and clear. How me? |
| 07 31 01 | P | Hawaii Cap Com. Sigma Seven. Over. |
| 07 31 07 | CC | Sigma Seven, Sigma Seven. Hawaii Cap Com. |
| 07 31 10 | P | Roger. Hawaii Cap Com, this is Sigma Seven. |
| 07 31 29 | P | Hawaii Cap Com. Sigma Seven. Hawaii Cap Com. Sigma Seven. UHF-high. Over. |
| 07 31 39 | P | Hello, Hawaii Cap Com. Sigma Seven. UHF-high. |
| 07 32 00 | CT | Sigma Seven, Sigma Seven. Hawaii Com Tech. On HF/UHF. How do you read? Over. |
| 07 32 04 | P | Hawaii Com Tech. Sigma Seven. Loud and clear. How me? |
| 07 32 21 | P | Hawaii Com Tech. Sigma Seven. Loud and clear on UHF/HF. Over. |
| 07 32 32 | CT | Roger, Sigma Seven. Read you on HF/UHF. Stand by for Hawaii Cap Com. |
| 07 32 37 | P | Roger. |
| 07 32 39 | CC | Sigma Seven. Hawaii Cap Com. Over. |
| 07 32 42 | P | Roger, Gus. I've been reading you for a long time. Over. |
| 07 32 45 | CC | Ah, that is good. We lost all contact with you. I have correct retrosequence time for [recovery] area 6–1. Are you ready to copy? |
| 07 32 57 | P | Stand by 1 second here. |
| 07 33 00 | CC | Are you ready to copy retrosequence time, Wally? |
| 07 33 02 | P | Okay, go. |
| 07 33 03 | CC | Roger, 08 51 27. |
| 07 33 07 | P | Roger, 08 51 27. |
| 07 33 11 | CC | That's correct. |
| 07 33 12 | P | Okay. |
| 07 33 15 | CC | Give me your status. |
| 07 33 16 | P | Roger. My status is go. I could receive all the stations in the Pacific, but they apparently weren't receiving me. Would you advise them to transmit in the blind. I had very good communications with the Pacific Command Ship. |
| 07 33 33 | CC | You say you had good communications with PCS? |
| 07 33 36 | P | That is affirmative. Ideal. |
| 07 33 39 | CC | Roger. You are cutting out here. It's difficult to understand you. That's good communications with PCS? |
| 07 33 45 | P | That is affirmative. |
| 07 33 46 | CC | Roger. Roger. |
| 07 33 49 | P | I could hear Watertown, Huntsville, and you, loud and clear all the time. |
| 07 33 58 | CC | Roger. |
| 07 33 59 | P | I still have ample fuel. The capsule is tracking beautifully in auto, retro mode. I have 81 [percent] auto and 80 [percent] manual. |
| 07 34 13 | CC | Wally. |
| 07 34 14 | P | Go ahead. |
| 07 34 15 | CC | Would you reset your clock? |
| 07 34 17 | P | Roger. To 08 51 27. Stand by. Roger. It is set to 08 51 27. Do you concur? |
| 07 34 33 | CC | Roger. I have that setting. |
| 07 34 37 | P | Roger. |

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|---|---|---|
| 07 34 39 | CC | When you take into account your error in c.e.t., it should be set at 08 51 31, Cape advises. |
| 07 34 47 | P | Roger. This means I have to punch retrosequence. Right? |
| 07 35 03 | CC | Will you give us a blood pressure? |
| 07 35 05 | P | Roger. |
| 07 35 35 | CC | Wally, give me a c.e.t. |
| 07 35 41 | P | Roger. I have—I'll give you 45. MARK [07 35 44] T 45 seconds. That's 07 hours, 35 minutes 45 seconds. Did you read, Gus? |
| 07 36 00 | CC | Wally, we lost you. I think your transmitter is fading out. I'll give you a c.e.t. at 07 36 10. MARK 07 36 10. [Computed mark garbled, unobtainable.] |
| 07 36 18 | P | Roger. I got your mark. I am 4 seconds fast. Did you read Hawaii? |
| 07 36 27 | P | Hawaii Cap Com. I am 4 seconds fast. Sigma Seven transmitting in the blind. |

## CALIFORNIA (FIFTH PASS)

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|---|---|---|
| 07 40 29 | CC | Hello Sigma Seven, hello Sigma Seven, this is Cal Cap Com, Cal Cap Com. Broadcasting in the blind. We have had a power failure on our receiver. I am broadcasting in the blind. Reset your clock for retrosequence at 08 51 33. This takes into account your clock error at last readout. You had last report had 27 seconds set in. This should be 33 by last c.e.t. check we had with you. Cape wants you to reset that at 33. This is Cal broadcasting in the blind. |
| 07 41 10 | P | Roger, Cal. I have set in 05—correction, 08 hours, 51 minutes, 33 seconds. Guaymas Cap Com, do you read? Over. |
| 07 41 35 | P | Guaymas Cap Com. Sigma Seven. Over. |
| 07 41 44 | CC | Sigma Seven, this is Cal Cap Com. Repeating broadcast in the blind. Cape advises reset your clock to 08 51 and 33 seconds, and 33 seconds. Cal out. |
| 07 41 59 | CC | Sigma Seven, this is Cal Cap Com, in the blind again. Make sure face plate is closed. Face plate closed. |
| 07 42 17 | CC | All right. This is—Sigma Seven—this is Cal. We have your change on T/M of 08 51 and 33, showing good. This is correct setting. |

## GUAYMAS (FIFTH PASS)

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| 07 42 33 | CT | Sigma Seven, this is Guaymas Com Tech. Do you read? Over. |
| 07 42 37 | P | Roger, Guaymas. How do you read me? Over. |
| 07 42 39 | CC | Roger. Sigma Seven. Guaymas Cap Com. Loud and clear. They had a power failure up the California way. We're reading your correct retrosequence time 08 51 33. On my mark, let see, your capsule elapsed time is at this moment 4 seconds fast, Wally. This—this takes into effect this error. Over. |
| 07 43 09 | P | Roger, Scott. I understand. Excuse me. Just finished my beef and vegetables. I am in good shape up here. I have had good communications with Al. The clock is set properly. The capsule is tracking well. |
| 07 43 29 | CC | Roger. Very good. Remember to close your face plate at this time. Remember also do it prior to reentry. |
| 07 43 39 | P | Roger. I have done that. |
| 07 43 41 | CC | Okay, at this time. |
| 07 43 42 | P | Roger. Face plate is closed and I have had a naval maneuver. |
| 07 43 48 | CC | Roger. |
| 07 43 50 | P | Everything looks real good, Scott. |
| 07 43 52 | CC | It looks real good down here, Wally. Doing a good job and we are looking forward to seeing you shortly at Midway way. |
| 07 44 00 | P | Roger. We'll get some boat duty in, too. |
| 07 44 10 | P | Scott. Do you have horizon scans on me? |
| 07 44 13 | CC | Roger. Wait one, Wally. |
| 07 44 16 | P | I would like to have you check my roll attitude. |
| 07 44 23 | CC | Roger, c.e.t. on my mark will be 7 hours, 44 minutes, 30 seconds. MARK. [07 44 30]T |
| 07 44 31 | P | What? Is that right? That's what my clock says. |
| 07 44 36 | CC | Right. That was c.e.t. The Cape asked for that. We are showing 4 seconds behind you, Wally. |
| 07 44 43 | P | Oh, okay. That was right on. Now what is my roll attitude on your scanner? |
| 07 44 50 | CC | Okay. Your roll scanner shows minus—minus—minus 10 [degrees], Wally. |
| 07 45 03 | P | Roger. I concur. Believe I am a little bit steeper than 10 [degrees] left. I'll bring that out with the manual axes and then let her fly it again. And see what she does. |

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| 07 45 20 | CC | Wally. How about one more blood pressure before you leave? |
| 07 45 28 | P | Roger. Stand by. |
| 07 45 34 | CC | Sigma Seven. On my mark, the ground elapsed time will be 7 hours, 45 minutes, 40 seconds. Stand by. MARK. [07 45 44]T |
| 07 45 46 | P | Roger. I concur. |
| 07 45 47 | CC | Roger. |
| 07 46 09 | P | Going to fly-by-wire low at this point. Manual lever in. The capsule attitudes appear to be very good. |
| 07 46 30 | CC | That's fly-by-wire low at this time. Sigma Seven? |
| 07 46 33 | P | That's correct. I just want to check this roll out during the daylight side. Pitch is real honest and so is yaw. I think I've got to correct about 6 degrees worth of roll though. |
| 07 46 50 | CC | Roger. Gyros are normal? Is that correct? |
| 07 46 52 | P | That's correct. |
| 07 47 10 | CC | Wally, we also show a gyro free position on the ground. |
| 07 47 14 | P | Roger. I just went to that free. Stand by. |
| 07 47 20 | CC | Roger. And do you plan to return to ASCS shortly? |
| 07 47 25 | P | Momentarily. |
| 07 47 26 | CC | Roger. |
| 07 47 27 | P | Just coming on to it. |
| 07 47 30 | CC | Okay. Stop the blood pressure. We got a good one, Wally. |
| 07 47 32 | P | Okay. Stand by—normal ASCS. |
| 07 47 39 | CC | Roger. We're reading—gyros normal. |
| 07 47 43 | P | Roger. The scanner test was what the problem was. And the roll went off as we anticipated it would. And I am going back to gyros normal, at this time, which is about 2 minutes early. This is the routine that was on the flight plan, if you'll see it. |
| 07 48 00 | CC | Roger. |
| 07 48 04 | P | Okay. We should pick up this roll problem that I had there now that we've got the scanners back on the line. Looked pretty good for pitch though, it's beautiful. |
| 07 48 18 | CC | Roger. And the gyros are showing, at this time, only a 4 degree difference, and that is decreasing. |
| 07 48 26 | P | Roger. That's the deal. That's what I wanted you to check for me while I was over your station, Scott. Thank you. So it looks like the ASCS is pure. I am now in—— |
| 07 48 37 | CC | Scanners are also in agree—pitch scanners in agreement with your gyros, and we have T/M LOS. |
| 07 48 45 | P | Roger. I'm happy here. |
| 07 50 12 | P | This is Sigma Seven. A 30 second HF check, at 07 50 minutes commencing at 10 seconds after that. This is a 30 second duration test, as I pass down through the coast of Baja California, en route to South—South America. Every system is working very properly. I have 5 more seconds of check to go. Test out. Sigma Seven. Switching to UHF for relay. |
| 07 51 38 | CC [Auto 2] | Warfare. Auto Two. |

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| 07 51 48 | CT | Sigma Seven. Cape Com Tech. Do you read? Over. |
| 07 51 51 | P | Roger, Cape Com Tech. I read you loud and clear. How me? |
| 07 51 57 | CC [Auto 1] | Warfare. Auto One relay. |
| 07 52 00 | P | Cape Com Tech. Sigma Seven. How do you read, UHF relay? |
| 07 52 12 | P | Cape Com Tech. Sigma Seven. On UHF. Over. |
| 07 52 16 | CT | UHF relay is good. Do you read? Over.. |
| 07 52 24 | CT | Sigma Seven, Sigma Seven. Cape Com Tech, Cape Com Tech broadcasting 1 2 3 4 5 4 3 2 1. How do you read? Over. |
| 07 52 33 | P | I read you loud and clear, Murph. How do you read me? Over. |

## QUITO (SIXTH PASS)

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| 07 52 38 | CC [?] | TMS calling. Repeat please. . . . Did you receive Cape Com Tech? Over. |
| 07 52 44 | P | Hello, Quito. This is Sigma Seven. Can you relay to Cape that I read them loud and clear? Over. |
| 07 52 50 | CC | Yes, you are coming through fine. Any traffic you have, be glad to take it. Go ahead. |
| 07 52 56 | P | Everything here is all set. Would you relay to the Cape, I have everything under control. We are all set here. |
| 07 53 02 | CC | Very fine. Thank you very much. You don't have any word to pass on? Can you say anything in Spanish to the fellows down here? |
| 07 53 12 | P | I'm afraid I can't. Except I would like to come down and visit you. I'm enjoying a beautiful sight of the country. |
| 07 53 19 | CC | Certainly nice to hear that, but could you say just a few greetings to them? They would appreciate it so much. They want to put you on their radio down here. |
| 07 53 27 | P | I must send my greetings to the other people of our same area. The fact that we are two hemispheres joined is even proven today by our capability of flying over each other's countries realizing that we are one and the same. |
| 07 53 44 | CC | Would you say, "Buenas dias," or something like that back to them? |
| 07 53 49 | P | Right. All I can do on that now is say, buenas dias you-all. |
| 07 53 54 | CC | Ha, ha. Thank you so much. I think they'll love that. |
| 07 53 57 | CC [Auto?] | . . . Cape Com Tech? Over. |
| 07 53 59 | P | Would you relay to Cape Com Tech—Cape Com Tech that I can read him? |
| 07 54 03 | CC | Who can you read? |
| 07 54 05 | P | Would you relay to Cape Canaveral Com Tech that I read him. |
| 07 54 10 | CC | That you do read Cape Canaveral right now? |
| 07 54 13 | P | That's affirmative. |
| 07 54 14 | CC | Okay, will tell him. Thank you a lot. |
| 07 54 18 | CC [Auto 1] | Sigma Seven. Auto One Cap Com. Did you receive Cape Com Tech? Over. |
| 07 54 23 | P | Sigma Seven. Affirmative. |
| 07 54 28 | CT | Sigma Seven, this is Cape Com Tech. This is Cape Com Tech. How do you read? Over. |
| 07 54 34 | P | Sigma Seven. Loud and clear. |
| 07 55 09 | CC [Auto 1] | Sigma Seven. Auto One Cap Com. Do you read? Over. |
| 07 55 14 | P | This is Sigma Seven. Affirmative. I do read. |
| 07 55 18 | CT | Sigma Seven, Cape Com Tech UHF/HF. How do you read? |
| 07 55 24 | P | Sigma Seven. Loud and clear. |
| 07 55 28 | CC | Were you calling Quito or Cape Com? |
| 07 55 33 | P | Trying to talk to the Cape. But apparently they don't realize I am still talking. Quito, I can hear them all loud and clear. |
| 07 55 42 | CC [Auto 1] | Cap Com. Did you read Cape Com Tech? Over. |
| 07 56 03 | CC [Auto 1] | Sigma Seven, Sigma Seven. Auto One Cap Com. If you read, give a short count. Over. |
| 07 56 10 | P | This is Sigma Seven. We don't have a transmitter exercise. I do read 1 2 3 4 5 5 4 3 2 1. Sigma Seven. Out. I'm tired of carrying on, Com. |

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| 07 56 33 | CC [Auto 1] | Sigma Seven, Sigma Seven. Auto One Cap Com. Can you read? Over. |
| 07 59 06 | P | At 7 hours, 59 minutes, 10 seconds, light value reading, for the black and white film, is 13 for ASA 64. Setting light value of 13. Taking picture number 7 with filter. The continent of South America is difficult to photograph because of all the weather. I will take a panorama at this time. Starting at 7 59 almost 8 hours. In fact, it will be 8 hours. MARK [08 00 00]T, 7, 8, 9 black photographs, black and white film. Ten photographs, black and white film. The shots are being taken at 250, 5.6 [1/250 second and f5.6] at infinity. Taking number 11, looking to the left. I am coming across the South American continent at this point. I have a large river in sight. Take a picture, camera facing down as much as possible. I believe I got the capsule window very nicely there. I'll come back to—B–1 now. I've shot the 12 first pictures. I'm on B–1, shooting at the cloud streaks. I've shot B–2 and these are all black and white shots, with Weather Bureau filter in at 08 02. I will take the last pictures of this series. That is the end of the Weather Bureau pictures. I believe we've taken enough to satisfy the requirements. Pulling out the filter. Restoring the slide to the back. Removing black back. |
| 08 03 37 | P | Bring out color back. Taking a light value reading of the South American continent at 08 04 commencing, gotta change the ASA number. ASA number changed to 160. Light value being measured at this time. Light value is 15. |
| 08 05 01 | P | Very interesting terrain pictures. I will take one of the horizon just for posterity. At this time, that picture was A number 12, resetting to B and now have B–1. Taking some colored pictures of the South American continent. I don't think we'll have much luck with them. |
| 08 06 09 | P | That was at B–2. Coming up on B–3. Pitch down at this time to approximately 10 degrees. The roll error that developed during the period where we had the scanners off has disappeared. At this point, I am going to increase the suit flow to approximately—just a tad to increase the cooling for reentry. See if I can bring it down a little bit more. There is almost perfect attitude. Yaw is good. Pitch is down a little steep. It's definite that the yaw reticle is not good for night work. |
| 08 07 46 | P | I'm going to stow the camera now for the check on the Durban light. As we did not have any luck with the flare. |
| 08 08 44 | P | Camera is stowed. Photometer is light enough to take out and leave out. I will make another check on a low-level gadget here before we terminate. And it has gone up about the thickness of one line. Is now reading 0.06, that is, less than 0.1. All of these will now be stowed in the glove box; they have been on the hatch, adjacent to the hatch detention spring nearest the emergency rate handle. In a vertical plane parallel to the bag that holds the extra goodies that can't be shoved other places. |
| 08 10 52 | P | At 08 hours and 10 minutes. Going to pitch up to reentry attitude shortly. No reason to keep glove box open at this time. Have to get the standard source of light. I may be able to get it. Put that away in a hurry. That'll stay there. That is the yaw cover. Everything else is ready. |
| 08 12 02 | P | Skies are getting darker. |
| 08 12 30 | P | Fly-by-wire low and pitching up to reentry attitude. Going to fly-by-wire low, now [08 12 39].T |
| 08 13 19 | P | Attitude okay. Pitching back down to reentry attitude, correction retroattitude. No reason to stay at reentry attitude. No reason to stay at reentry attitude, when we can see so well in retroattitude. And this is truly the attitude we need to fly. Coming up on retroattitude. Roll checks out. Yaw checks out. Reentry attitude is on select. Stopping pitch shortly. [Pitch is drifting in very slowly.] Pitch is stopped—on pitch. Going to ASCS auto, gyros are normal, maneuver is off. |
| 08 14 34 | P | Closed face plate. Opened it momentarily, merely to wipe my nose, and try to clear a lens, which I cannot do. Reentry select. Camera is stowed. I will now extinct the standard light source—and cannot move the cabin light on the starboard side; therefore, I will extinct it as a continual reference. There, it is now extinct, at 3.3. Cabin source extincted at 3.3 at 08 hours 15 minutes and 35 seconds c.e.t. |
| 08 16 06 | P | Fly-by-wire low did check out very well. |
| 08 18 02 | P | Moving suit setting to 8 at this time. That is the suit coolant quantity settings to 8. Suit inlet is now 65 [degrees], which is comfortable. In fact, I was quite cool before, but I'd like to get cool again. And the dome is about 73 [degrees]. |

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| 08 18 23 | P | Cabin is all set. I don't want to lower the dome any more. It's been very good. Checking on time 18 minutes. Okay on the clock. Thrusters—roll left auto is 119 [degrees]. Roll right auto is 115 [degrees]. Roll left manual is 100 [degrees]. Cabin heat exchanger is 43 [degrees]. Pitch up auto is 95 [degrees]. Pitch down auto is 95 [degrees]. Yaw left auto is 80 [degrees]. Yaw right auto 100 [degrees]. 250 inverter, oh how nice, less than 160 [degrees]. The 150 inverter—is 110 [degrees]. Standby is 125 [degrees]. Turning to cabin heat exchanger. |
| 08 19 42 | P | Checking out d-c volts at this time. Main bus, 24 [volts]; isolated bus, 27½ [volts]; one is 25 [volts]; two is 25 [volts]; three is 25 [volts]. Standby one is 25 [volts], standby two is 25 [volts], isolated is 28 [volts]. Back to main. ASCS and fans are both 115 [volts]. Drawing 20 amps. Oxygen remaining 50 [psi, in hundreds] primary, 75 [psi, in hundreds] secondary. |
| 08 20 47 | P | Will perform an orientation test at this time while I'm on ASCS and not so busy. Reaching for manual handle—and on it, exactly on it. Reaching for yaw attitude. I hit it at 20 degrees, right 20 degrees. Reaching for emergency handle. Right on it, negative, that one—slightly off touched the side of the box first. I didn't hit it exactly, I'm sure. That is completion of the orientation test. |
| 08 21 29 | P | I have the Moon in sight. There is Venus. The Moon is tracking beautifully. Right on in yaw, right on in pitch, right on in roll. All three axes are very beautiful. |
| 08 22 07 | P | Seems so sad just a little less than a half an hour left to play with this. I am now going to fly-by-wire low. Gyros free, to pitch down to observe the Durban light. Gyros free, fly-by-wire low, correction, I am going to manual proportional at this point. I have not charged any rates so I will go back to ASCS. Clean. Over to rate command. Manual proportional out. I will try this mode out for size. Down a very small amount, 23 minutes. |

## INDIAN OCEAN SHIP (SIXTH PASS)

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| 08 23 05 | P | Indian Ocean Ship, this is Sigma Seven. Do you read? Over. |
| 08 23 15 | P | Indian Ocean Ship. Sigma Seven. Do you read? Over. |
| 08 23 28 | P | Indian Ocean Ship. Sigma Seven. Do you read? Over. |
| 08 23 40 | P | Indian Ocean Ship. Sigma Seven. Do you read? Over. |
| 08 23 49 | CC | . . . how do you read? Over. |
| 08 24 05 | P | Indian Ocean Ship. Sigma Seven. Do you read? Over. |
| 08 24 08 | CC | Roger, Sigma Seven. Read you 5 by 5. |
| 08 24 12 | P | Roger, Indian Ocean Ship. Have not seen the flare. I am pitching back up to retroattitude. |
| 08 24 20 | CC | Roger. Were you able to check the Durban lights? |
| 08 24 22 | P | I mean the Durban lights. I was not able to see them. I see some lights on the ground—at this time—in the middle of the window, which is just about the time for the Durban lights. They are underneath clouds and are not good enough for complete recognition. Over. |
| 08 24 49 | CC | . . . short report. |
| 08 24 56 | P | Say again. Over. |
| 08 24 59 | CC | Could you give us a short report? Over. |
| 08 25 01 | P | Roger. I am back in—retroattitude. I'm going back to chimpanzee configuration. The gyros are normal. Everything is stowed but the photometer, which will be stowed shortly. |
| 08 25 22 | CC | Roger. |
| 08 25 26 | P | I have set my suit circuit cooling valve to position number 8 just to precool a little bit, and it is working properly. |
| 08 25 37 | CC | Roger. Can we have one more blood pressure at this time? Over. |
| 08 25 44 | P | Roger. Coming up. |
| 08 25 59 | CC | Sigma Seven. Did you say that your att—your mode was ASCS retro? |
| 08 26 05 | P | I'm coming to that just now. |
| 08 26 06 | CC | Roger. |
| 08 26 15 | P | I have the moon setting at this point. |
| 08 26 21 | CC | Say again. |
| 08 26 22 | P | The moon just set. And I have lighting in sight over this area. |
| 08 26 25 | CC | Roger. Are you about ready to go through your preretrosequence checklist? |

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| 08 26 31 | P | That's affirmative. Just stand by 1 second. Will go to ASCS. |
| 08 26 37 | CC | Okay. |
| 08 26 44 | P | Okay. Ready for preretrosequence checklist. |
| 08 26 49 | CC | Do you want some help with it? |
| 08 26 50 | P | Say again. |
| 08 26 52 | CC | Do you want some help with the checklist? |
| 08 26 54 | P | Negative. I am in attitude at this time. I will give you the rest of the checklist for your reading. |
| 08 27 01 | CC | Roger. Would you push to stop blood pressure, please. |
| 08 27 07 | P | Roger. Have got that done. I've got attitude select retro. |
| 08 27 15 | CC | Roger. |
| 08 27 17 | P | I've got retro correction thrusters on—normal instead of low. I'm going to switch to HF antenna to bicone although I'm using UHF—at this time. |
| 08 27 32 | CC | Roger. |
| 08 27 38 | P | I am on bicone, and the visor is closed. All other items are in their proper position. Over. |
| 08 27 48 | CC | Roger. |
| 08 27 52 | P | Checklist complete except for squib switch arm. |
| 08 27 56 | CC | Roger. Could you give us a cabin pressure and suit readout? |
| 08 28 00 | P | Roger. Stand by. The cabin pressure is 4.9 [psia] almost 5. The suit temperature inlet is 63 [degrees]. The cabin temperature is 92 [degrees]. |
| 08 28 20 | CC | Sigma Seven. Say again cabin pressure. Did not read you. |
| 08 28 24 | P | Cabin pressure is 5, 5.0 [psia]. |
| 08 28 29 | CC | Roger. |
| 08 28 35 | P | I am warming up gyros although they should have a bypass anyway. |
| 08 29 02 | CC | Sigma Seven. Everything looks good. IOS standing by. |
| 08 29 06 | P | Roger, IOS. It looks good here. |
| 08 30 45 | CC | Sigma Seven. We have 1 minute to LOS. |
| 08 30 48 | P | Roger. I am completely secure here and ready for retrofire on command. |
| 08 30 49 | CC | Roger. |
| 08 31 11 | P | All attitudes check out perfectly here. How do they check with you there? |
| 08 31 27 | P | This is Sigma Seven. I will check fly-by-wire high thrusters at this time. |
| 08 34 15 | CC | . . . . |
| 08 34 32 | CC | . . . . |
| 08 34 50 | P | At this time, I have completed the high thruster checks. A delayed report. Each axis worked beautifully. I now have 75 [percent] auto [fuel] and 75 [percent] manual [fuel]. |
| 08 35 41 | P | All attitudes are responding very nicely. Suit heat dome is about 72 [degrees], suit inlet is about 63 [degrees], coming down just a tad. Definitely it—optimum flight setting of about 7½ to 8 for this vehicle. I will crack it up another notch to 8. I have set the—suit regulator for the coolant quantity to position 8, at c.e.t. 08 36 23. |
| 08 36 35 | P | That's a more accurate reading on fuel. If I can get my fingers up to, it would be 78, 78 [percent]—prior to retro. I am set up to have retro performed—automatic control—subsequent to retro—I will switch to fly-by-wire and pitch up to reentry axis—correction—subsequent to retro jettison, switch to fly-by-wire, pitch up reentry attitude and select rate command at 08 . . . . |
| 08 40 35 | P | Cabin, at this time, is monitoring at about 4.8 [psia]. The suit apparently about 4 [psia], and the suit pressure gage is reading 4.9 [psia]. This is the suit pressure gage on the suit. |
| 08 41 03 | P | The index finger—finger-tip light, left hand, finally failed. They really do not have the longtime durability that we're looking for. |
| 08 41 19 | P | The horizon is very clear. Roll and pitch look very good. Yaw looks good. I believe we've got a medley of stars coming into sight now to give us a fix. |
| 08 41 37 | P | One gets the illusion that you're on a train or some other vehicle, due to the humming, and you feel that you should be on a track of some kind and you're driving down. Much like the sound of the ship when you're under way at sea. The blower noise, I assume, and the inverters give you the same illusion. |
| 08 42 14 | P | Okay. We got Grus, and we got Jupiter in the right position. So our yaw reference is right on the money. No problem with that. When I lean way down I can pick up Jupiter, and Fomalhaut should come down very shortly after. |
| 08 42 36 | P | Have a slight roll to the right, which is indicated by the gyro as well. Coming on 8 minutes and 50 seconds. |

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| 08 43 24 | P | $T_r$–10 relay must have set in, although I have no clues—other than the ASCS rate gyros coming up and I can't bet on those since they're in anyway by the switch being selected to $T_r$–10 bypass. |
| 08 43 49 | P | Gyros normal. Attitude—fly-by-wire. Retrofire armed, the 3 fuses are armed. We are fat! |
| 08 44 04 | P | There is Jupiter, and there is Fomalhaut in the middle of the window, this time around. Attitude is real stiff now. Just by chance, I assume. Roll is right on, yaw is right on. |
| 08 44 41 | P | Cabin $PO_2$ at this time is about 3.9 to 4.0 [psi]. Cabin heat exchanger is about 50 [degrees], at this time. Dome just happens to be on an upswing now. |
| 08 45 01 | P | Dome, cabin dome is about 57 [degrees]. Cabin temperature is 90 [degrees]. Suit inlet is 62 [degrees]. Oxygen remaining 50 [psi, in hundreds] primary, 75 [psi, in hundreds] secondary. All electrical looks good. Fuel remaining, still is, 78, 78 [percent]. |
| 08 45 53 | P | Coming up on the 5 minute to go to retrograde light. |
| 08 46 34 | P | Five minute to go retrograde light is on. |
| 08 47 01 | P | Attitude looks very good, nice and stiff. Pressure is holding very well. Vehicle looks very good. |
| 08 47 23 | P | Roll left, not so good. Let's see what we have. Five degrees roll shows up very readily. |
| 08 48 21 | P | Checking over the other systems. They all seem to be fairly constant. Suit dome is still about 71 [degrees], suit inlet is 62 [degrees], which this time is comfortable. Cabin pressure and suit pressure and suit pressure gauge all match within about 1/10 of a psi. Getting some light in the periscope at this time. |
| 08 48 54 | P | About 2 minutes to go to retrofire. I'm in UHF-high, transmit and record, R/T. All fuse switches are in the proper position but for the landing switch fuses. |
| 08 49 17 | P | Here comes some sunlight. |

PACIFIC COMMAND SHIP (SIXTH PASS)

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| 08 49 55 | P | Pacific Command Ship, this is Sigma Seven. Do you read? Over. |
| 08 50 04 | CC | Sigma Seven, this is Pacific Command Ship. Do you read? Over. |
| 08 50 08 | CC | Affirmative, Seven. Are you reading me? |
| 08 50 09 | P | Roger, Al. Read you loud and clear. |
| 08 50 12 | CC | Understand you're ready to go home, Wally. |
| 08 50 14 | P | Roger. I've got everything all set, Al, except for the squib switch, which I'll put on your count. |
| 08 50 20 | CC | Very good. You're going to use ASCS retro, and manual proportional standby. |
| 08 50 26 | P | That is affirmative. The handle is sitting in at this time; I'll pull it out. |
| 08 50 31 | CC | Okay. Your attitudes look very good, Wally, and your clock is 5 seconds fast. So with the present setting, we should time out right on time. |
| 08 50 39 | P | Roger, Al. I've got—I'm coming up on 30 seconds to go. I'll give you my light. |
| 08 50 46 | CC | Okay. |
| 08 50 49 | P | I've got the 5 minute light on. This is the 30 second light—5, 4, 3, 2, 1, LIGHT [08 51 02] T. There it is. I've got a light and a tone. Tone is out. |
| 08 51 07 | CC | Very good. The timing is right on, Wally. I'll count down to retrosequence, and you'll arm the squibs at 5. |
| 08 51 14 | P | That's correct. |
| 08 51 22 | CC | Here we go at 10, 9, 8, 7, 6, 5. |
| 08 51 28 | P | Squib arm. |
| 08 51 30 | CC | 3, 2, 1. SEQUENCE [08 51 32] T. |
| 08 51 34 | P | I have sequence, and capsule is nice and tight. Got attitude green. She sitting here like a tight rock, Al. |
| 08 51 42 | CC | Roger. Attitude looks very good from here, Wally. |
| 08 51 44 | P | Yeah. They looked beautiful here, too. Oh boy! She's a good little capsule, I'll clue you. |
| 08 51 52 | CC | Here you go. |
| 08 51 53 | P | Roger. |
| 08 51 57 | CC | 5, 4, 3, 2, 1, 0. [08 52 02] T |
| 08 52 04 | P | I've got (retro rocket number) 1, and she's holding real tight. Very tight. I got 2, my attitudes are right on the money. I've got 3. |
| 08 52 17 | CC | Very good. We confirm on T/M. Retros 1, 2, and 3. Attitudes holding very well. Retro jettison switch to arm. |
| 08 52 24 | P | Roger. |

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| 08 52 25 | CC | Emergency retro jettison fuse switch is on. |
| 08 52 28 | P | Roger. They are all on. Retro jet is armed. Got sunlight. Everybody's very happy. I'm going to fly-by-wire, Al, to pitch to reentry attitude. Manual is going in. |
| 08 52 41 | CC | And we show you have about 68 percent auto and 84 percent manual fuel left. I think our readings are probably a little closer than yours. |
| 08 52 50 | P | I've got 68 [percent] auto and 78 [percent] manual. |
| 08 52 56 | CC | Roger. |
| 08 53 00 | P | Standing by for retrojett. I have retrojett, and light is green. I could hear it, by the way. |
| 08 53 10 | CC | Very good. We confirm retro jettison. |
| 08 53 12 | P | Okay. I am using fly-by-wire low to pitch up to reentry attitude. |
| 08 53 18 | CC | Okay. We're following you here. |
| 08 53 20 | P | Roger. I am a little sloppy on the roll as you may see. No strain. I'm going to put her right into ASCS when I get up here. Okay. She's in reentry as far as roll goes. Okay. The scope is coming in. I'm on the gyros. |
| 08 53 40 | CC | Roger. We confirm scope retract on T/M. |
| 08 53 43 | P | Roger. |
| 08 53 44 | CC | And you're very close to reentry attitude. |
| 08 53 47 | P | Roger. I'm in reentry attitude now. |
| 08 53 51 | CC | Roger. Understand you will go to RSCS prior to 0.05g, with aux damp as a back up. |
| 08 53 57 | P | That is affirmative. I'm now going to ASCS at this time. And she's tight and holding. |
| 08 54 05 | CC | Understand you are in ASCS. |
| 08 54 07 | P | That is correct. I want to see if the reentry logic was in. |
| 08 54 11 | CC | Roger. And you will go to RSCS prior to 0.05g. |
| 08 54 15 | P | That is correct, Al. I want to give her a checkout. Those retros were real cute, and right on the money. |
| 08 54 25 | CC | Roger. |
| 08 54 26 | P | I'd say attitudes didn't vary 1 degree. |
| 08 54 29 | CC | Real tight. Real tight. |
| 08 54 30 | P | Righto. I think they're gonna put me on number 3 elevator. |
| 08 54 35 | CC | Ha, ha. Good show. Stand by. I'll call the Cape. See if they have anything. |
| 08 54 39 | P | Okay, Al. |
| 08 54 49 | P | Okay. Post retro, I read 65 [percent] auto [fuel], and about—78 [percent] manual [fuel]. Manual lever is in. I'm in ASCS at this time. |
| 08 55 10 | CC | Understand you are still in ASCS but the manual lever is in. |
| 08 55 14 | P | That is correct. What is my nominal time for 0.05g. |
| 08 55 19 | CC | Standing by, Wally. We have LOS. See you later. |
| 08 55 22 | P | Roger, Al. |

WATERTOWN (SIXTH PASS)

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| 08 56 57 | CT | Sigma Seven, Sigma Seven, this is Watertown Com Tech. UHF. How do you read? |
| 08 57 02 | P | Roger. Watertown Com Tech, this is Sigma Seven. Read you loud and clear. How me? |
| 08 57 07 | CT | Sigma Seven, this is Watertown Com Tech. I read you weak, I read you weak. Please make another transmission. |
| 08 57 13 | P | Roger. I read you loud and clear, Watertown. How do you read me now? |
| 08 57 19 | CT | Sigma Seven, Sigma Seven, this is Watertown Com Tech. I read you broken up. I read you broken up. Please make another transmission. |
| 08 57 27 | P | Roger. Watertown. I read you loud and clear. Please make your transmissions to me in the blind, if I do not acknowledge. |
| 08 57 37 | CT | Sigma Seven, Sigma Seven, this is Watertown Com Tech. I read you 3 by 3. Stand by. I'll turn you over to Com—Cap Com. |
| 08 57 45 | P | Roger. |
| 08 57 55 | CC | Sigma Seven, this is Watertown Cap Com. |
| 08 57 58 | P | Roger. Watertown Cap Com. How do you read me? |
| 08 58 02 | CC | Weak and unreadable, at the moment. But I will transmit in the blind. Please check to make sure your face plate is closed and sealed. Do you read? |
| 08 58 10 | P | Roger. Face plate closed and sealed. |
| 08 58 13 | CC | Will you verify that your scope is fully retracted and the door closed. Does it look dark? |
| 08 58 18 | P | The scope is retracted, and I think you'll have to confirm that for me. |
| 08 58 23 | CC | Understand—I just barely understood you, but I'll go ahead. Will you confirm that the UHF/DF switch is in the R/T position. |

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| 08 58 32 | P | That is correct. |
| 08 58 37 | P | I am standing by to check out my RSCS mode at the proper time. |
| 08 58 47 | CC | Sigma Seven. Did not understand the last transmission but assume you read that we should have UHF/DF switch in the R/T position. I do not have any landing recovery information for you at the moment, but I'll pass it on to you if I can. |
| 08 59 03 | P | Roger. Have you acquired track? |
| 08 59 09 | CC | Expect LOS blackout anytime. I'll keep transmitting in the hope that it will get it on your tape recorder. |
| 08 59 16 | P | Roger. |
| 08 59 22 | CC | At main chute deploy if you get a chance, will you shut off your three water controls to help out the data reduction people? |
| 08 59 28 | P | Wilco. If I get a chance. Ha, ha. |
| 08 59 36 | CC | Sigma Seven. Don't forget to watch your cabin pressure and your altimeter. If they do not check, pull your decompress or your snorkle handle. |
| 08 59 45 | P | Roger. Understand. |
| 08 59 50 | CC | Sigma Seven. I'll keep on talking in the hope that we can clear this blackout problem. At 17K, your $O_2$ emergency light should come on. At that time, pull your snorkle. |
| 09 00 01 | P | Roger. Understand. |
| 09 00 04 | CC | You should have sent your blood pressure. |
| 09 00 07 | P | I did. |
| 09 00 11 | CC | I still have you on T/M. No blackout yet. |
| 09 00 13 | P | Roger. I'm going to check out rate command at this time. |
| 09 00 18 | CC | Roger. Understand. Checking out rate command. |
| 09 00 29 | CC | Sigma Seven. Do you still read? |
| 09 00 31 | P | Sigma Seven. Read you loud and clear. How me? |
| 09 00 34 | CC | Clear. |
| 09 00 35 | P | Roger. |
| 09 00 40 | CC | Wally, by the way, how do you feel? All your systems okay at this time? |
| 09 00 43 | P | Oh, they're beautiful—very good. Every control mode has worked perfectly. |
| 09 00 53 | CC | Lost you on T/M. |
| 09 00 55 | P | Roger. |
| 09 01 19 | P | I have selected aux damp and rate command at this. The window is almost completely occluded. It would be impossible to see out of it at this point. |
| 09 01 38 | P | I'm seeing things come off, but I can't see them very clearly. There we go into 0.05, a green. I am hands off at this point. In rate command, in aux damp. And I have a roll rate started. A slight pitch rate, not bad at all. I can see out the window for some strange reason at last. There goes another long spiral like looking device. I will give another blood pressure at this point, subsequent to 0.05g. All rates are very nominal. Rate command is working quite well I would say. |
| 09 02 44 | P | Going back into g-field. And the attitude looks very stable. I'm rolling right around the horizon. I'm going to stop my blood pressure at this time—and sit back here and regroup. I can see the ion layer. I'm inverted at this time. |
| 09 03 14 | P | Attitudes are controlling very well. Seems to be plenty of manual fuel. I'm still at 72 percent. Definitely has the cyclic rate in pitch at this point. Yaw is fairly stiff; g is building up. Capsule is quite stable. There is a green flow—and looks like orange streaks every once in a while. RSCS is doing very well on reentry. Rather unusual slow roll. Building up to 2g's. I have plenty of fuel in rate command. Seeing sparkles coming by now. A definite green glow, like a limeade; g's building up. Oscillations are very good at this point. About 3g. |
| 09 04 18 | P | Still in a relatively horizontal attitude. Rate command working well. Glad she's holding. Doing very well. Coming up to 5½ [g]. Rate command still holding, fuel is still 70 [percent], seems low. Coming up to 6½ [g], 7g's. Coming up to 8g. Rate command holding. Taking a pretty big yaw out. Not too bad, I have it pretty well. Manual [fuel] is 60 percent. She's flying it very well. |
| 09 05 29 | P | Coming off. Peak-g was an indicated 7½ [g]. |
| 09 05 38 | CC | I read you weak. How do you read? |
| 09 05 40 | P | Roger. Read you well, loud and clear. I still have about 3g on. Capsule performing very well. Rate command holding pretty well. Altimeter off the peg. Attitudes holding very well. |

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| 09 06 05 | CC | Sigma Seven, this is Hawaii Cap Com. |
| 09 06 07 | P | Roger. Go ahead. |
| 09 06 09 | CC | Everything appears to be nominal. |
| 09 06 11 | P | Roger. Seems nominal here. Everything looks good. Got 55 percent auto fuel. Passing through 70,000 feet, 65,000. Attitudes are very stable. Coming up on 60 [thousand]. Rate command oing very well. Coming up on 50 [thousand]. She looks like a sweety. Coming up on 45,000. I'm down to about 1g. Preparing to punch the drogue, at 40, 41 [thousand]. I'm punching drogue, and the drogue is out. You can hear it, I can't see it because of the clouds. Attitudes are holding well. Manual lever is in. RSCS fuel is going pretty fast. I can see the drogue now. Drogue looks very good. I'm going to aux damp too. Actually don't need it. Rate command is burning itself out. And aux damp is doing nothing, just sitting there. I'll put in auto mode just to let her pump out. |
| 09 07 30 | CC | —about 3 seconds. |
| 09 07 31 | P | Roger. I'm coming down on 20,000 [feet]. Standing by for snorkle. Cabin pressure is increasing. Snorkle should go. I believe snorkle lid blew. I felt them. I will pull it anyway. I have an emergency rate. I think I led the snorkle a little bit on that one. |
| 09 07 58 | P | I'm dumping $H_2O_2$. Switch fuse on. Standing by. Recovery arm is "arm". Standing by for main chute. All switches are in proper position. Manual fuel is almost all gone. There goes drogue and main is out. It's—she's out beautiful. Bright blue sky. And it's dereefed, and looks like a sweety pie. Auto fuel is dumping. Rate of descent is about 35 [fps] at this time. I see no problems at all. I'm going to get prepared for impact. Auto fuel is dumping out. Cabin pressure is increasing properly. All systems look real good. I am cool, I am not hot. Main chute looks delightful. Rate of descent is 35 feet per second. I have no reason to select anything else. Landing bag is out. |
| 09 09 09 | CC | Roger, Wally. How do you feel? |
| 09 09 10 | P | I feel marvelous. This is a beautiful flight, wasn't it? |
| 09 09 15 | CC | Understand, you feel marvelous. |
| 09 09 18 | P | That is affirmative. I'm opening visor at this time to relieve my ears. |
| 09 09 26 | CC | Did you get the weather in the recovery area? |
| 09 09 29 | P | I probably had too much to say. What do you fellows have? |
| 09 09 32 | CC | Roger. Weather is 2,000 broken, visibility 10 miles, 3-foot seas. We don't have any tracked IP yet but you should be very close to the *Kearsarge*. |
| 09 09 42 | P | Roger. Sounds good, Gus. It's a beautiful chute here. I want to get a good description out before we got into the—the drink here. I'm preparing for impact by disconnecting the visor hose. |
| 09 10 01 | CC | What's your altitude, Wally? |
| 09 10 03 | P | Say again. |
| 09 10 06 | CC | Altitude? |
| 09 10 07 | P | I'm now at about 6,000 feet. |
| 09 10 12 | CC | Understand, 6,000. |
| 09 10 13 | P | That's correct. I'm not rolling at all on this chute. Okay, I've got that darn visor hose off, and the Velcro strap loose. Visor seal is dumped. I take off the exit hose from the helmet—and stuff that up in the tuleries. I'm not even hot here, Gus. |
| 09 10 55 | CC | You say it's hot. |
| 09 10 56 | P | I am not hot. I am very comfortable. |
| 09 11 01 | CC | Say again here. Just don't read. |
| 09 11 03 | P | I am very comfortable. |
| 09 11 07 | CC | Talk slow. You come in clear then. |
| 09 11 09 | P | Roger. I am very comfortable. |
| 09 11 14 | CC | Very good. We understand. |
| 09 11 17 | P | I want to stay aboard. |
| 09 11 22 | CC | . . . . |
| 09 11 24 | P | I am turning off ASCS bus. I'm going to get rid of these coolant valves that the fellows wanted, they're all going to 0. And I hear the aux beacon already. |
| 09 11 58 | CC | . . . . |
| 09 13 06 | P | I am about ready to impact now. I'm just about on the water. |
| 09 13 46 | P | Oh! Stay dry, baby. |
| 09 13 52 | P | Okay. It's taking a while to right itself but I think I've got the small end out of the water here. Can you read? Over. |

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| 09 14 01 | Flag [2] Plot | Roger. Sigma Seven. Flag Plot. Are you stable and on the water? |
| 09 14 05 | P | Looks like I'm stable on the water. The whip antenna is up. I can see it. I will switch to whip antenna. |
| 09 14 13 | P | I am definitely canted over pretty far, but there seems to be no water in the capsule, and I am very comfortable. She is righting herself very nicely, at this time. |
| 09 14 23 | CC | Roger. Carrier has you visual and the helos are on their way. |
| 09 14 28 | P | How about that? That's great. |
| 09 14 32 | CC | Do you still feel better? |
| 09 14 33 | P | Oh! I always feel better. There, she's getting nice and straight now. |
| 09 14 42 | CC | Say again, Wally. |
| 09 14 45 | P | She's getting up there nice and straight now. |
| 09 14 49 | CC | Talk very slowly. I have difficulty reading. |
| 09 14 51 | P | Okay. She's almost erect in the water at this time. I'm going to put up the whip antenna, Gus, and turn the squibs off. Stand by. |
| 09 15 05 | CC | I'm sorry, Wally. I didn't read that. |
| 09 15 09 | P | Okay. I have put the whip antenna up, and I'm turning off the arm squibs. |
| 09 15 17 | CC | Whip antenna is up. You're turning off the squib arm. |
| 09 15 20 | P | That is correct. |
| 09 15 22 | P | Okay. I'm going to check the cockpit, to be sure we don't get the boys in trouble. Everything looks real good, Gus. This is a real sweetie pie of a capsule. |
| 09 15 34 | CC | Roger. I agree. |
| 09 15 36 | P | I am in comfort, absolute complete comfort. The suit inlet is now 72 [degrees], the cabin is about 98 [degrees]. That's all. I feel very comfortable. |
| 09 15 51 | CC | Roger. Repeat the last part before the very comfortable. |
| 09 15 55 | P | The suit inlet temperature is 72—72 [degrees]. The cabin temperature is 98—98 [degrees]. I'm going to retract the scope manually to get it out of the way for the boys when they come around. |
| 09 16 27 | CC | Wally. You landed about 9,000 yards from the carrier. How about that? |
| 09 16 30 | P | That's pretty close, isn't it? |
| 09 17 33 | P | Boy, this is a sweet little bird. I just can't get over it. |
| 09 18 10 | CC | Wally. Hawaii Cap Com. |
| 09 18 12 | P | Go ahead. |
| 09 18 16 | CC | Recovery has been advised of your status. You're comfortable. They see the whip antenna, and they are on the way. |
| 09 18 22 | P | Very good. I am very comfortable. |

## RECOVERY (SIXTH PASS)

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|---|---|---|
| 09 18 33 | R1 | Hello Astro, hello Astro, this is Swiss One. How do you read me. Over. |
| 09 18 37 | P | Roger. Swiss One, this is Astro. How are you today? |
| 09 18 40 | R1 | Fine, fine. Got your squibs off. Give me a short count, please. |
| 09 18 44 | P | Roger. A short count follows: 1 2 3 4 5 5 4 3 2 1. This is Astro. Sigma Seven. Very happy to be back in the Pacific league. |
| 09 18 57 | R1 | Good. Glad to be able to talk to you. |
| 09 19 00 | P | Oh, it's a good habit. |
| 09 19 06 | R1 | Hello Astro, this is Swiss One. We have you on sight. You're looking good from here, on the green dye. |
| 09 19 16 | P | Roger. I seem to be bathing in it, don't I? |
| 09 19 20 | R1 | Roger. I'm going to fly overhead, come back around and drop the swimming team. |
| 09 19 23 | P | Okay. Good show. |
| 09 19 32 | R1 | Wally. You look fine. |
| 09 19 34 | P | Good show. How's it? She looks pretty erect to me. She's canted off a little bit towards what would be my left side. Is that correct? |
| 09 19 42 | R1 | That's affirmative. |
| 09 19 43 | P | Roger. |
| 09 19 46 | R1 | Okay. We're going, now coming in with the swimmers. |
| 09 19 48 | P | Roger, Swiss One. |
| 09 19 54 | P | I can hear you now. |

[2] Communicator on board the recovery vessel, U.S.S. *Kearsarge*.

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| 09 19 55 | R1 | Roger. You've got four helicopters overhead. |
| 09 19 59 | P | Oh, that'll do. |
| 09 20 18 | P | Tell the fellows I am perfectly comfortable. I can wait as long as they want. |
| 09 20 22 | R1 | Understand. |
| 09 20 23 | P | Okay. Don't tell them. Don't let them get their hands cut on something on here—go at it casually. |
| 09 20 30 | R1 | Roger. |
| 09 20 31 | P | Thank you. |
| 09 21 12 | R1 | Okay, Astro. The swimmers are in the water. |
| 09 21 14 | P | Roger. |
| 09 21 30 | P | I see a little old string hanging along down the side here. Oh! That's my dye marker. |
| 09 21 36 | R1 | I see your dye marker; is very bright green. |
| 09 21 39 | P | Yeah. I can see it through part of my window. Apparently, what I was looking at was the piece of string and that was the dye marker. Howdy fellows! |
| 09 21 51 | P | Do they know I'm all right? I assume, I heard them knock on the capsule. |
| 09 21 54 | R1 | Astro. Understand you requested you—you want to remain in the capsule? You want to know if we know that? |
| 09 22 00 | P | I assume they do. Don't they? |
| 09 22 03 | R1 | Right. |
| 09 22 15 | R1 | Astro. This is the Swiss pilot. The carrier is about three-quarters of a mile—closing. |
| 09 22 24 | P | Okay, pilot. I think I would prefer to stay in and have a—a small boat come alongside and using your collar routine, of course, to support me, and having a ship pickup. Over. |
| 09 22 38 | R1 | Roger. Understand. You want ship's small boat. Will give them that word right away. |
| 09 22 41 | P | Okay. I think they are briefed to make a—attachment with a small boat and then hoist me aboard. |
| 09 22 51 | R1 | Please say again, the last. |
| 09 22 54 | P | I understand that this is the *Kearsarge*, is that correct? |
| 09 22 57 | R1 | Affirmative. |
| 09 22 59 | P | She is briefed, I understand, to bring me and the capsule aboard together. |
| 09 23 05 | R1 | I'll wait one. |
| 09 23 06 | P | Okay. |



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